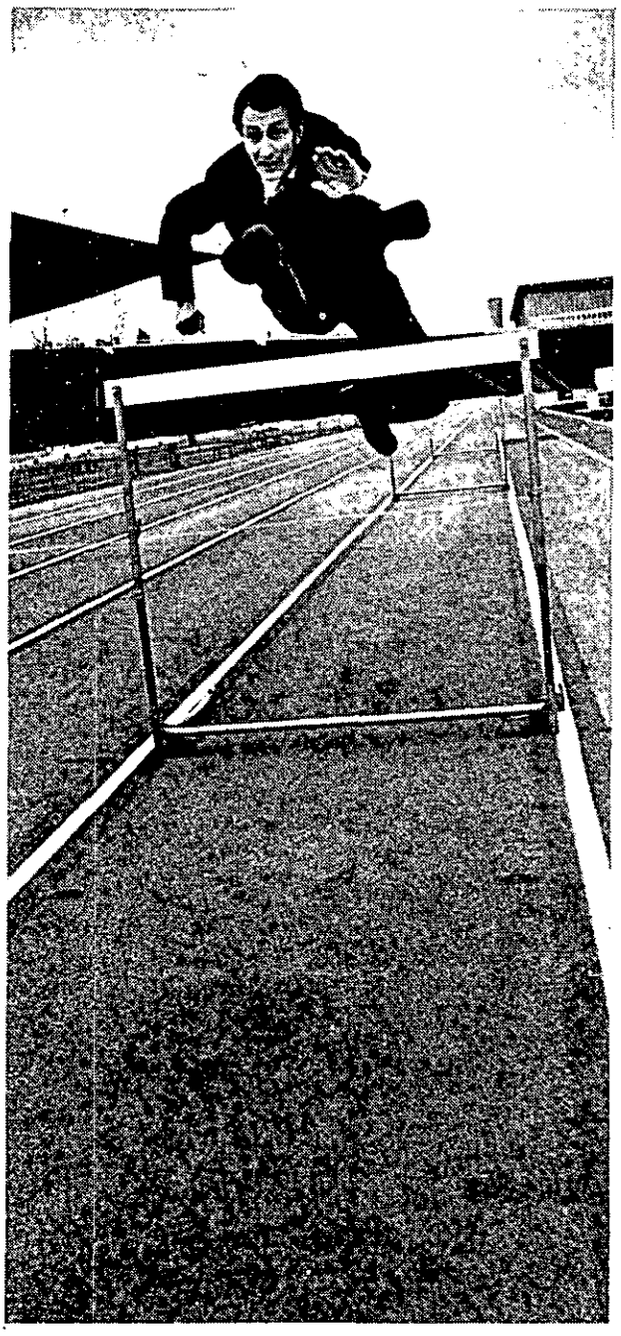
HE

Hospital Engineering

JULY 1975

Institute of Hospital Engineering

How not to put a foot wrong when choosing a new boiler.



Deciding on a new boiler plant can be full of hurdles.

Take the technicalities. What new equipment is there around? How do you work out the most efficient system for your needs? What fuel will you decide on – and why? How can you save energy?

If the technical ins and outs don't make you dizzy, turn your mind to the financial side of things.

Where does the capital come from and how do you pay it back? Which fuel is the most economical, now and in the future?

Now for the 64,000 dollar question. Are you making a mistake installing a new boiler – is it possible to convert your existing plant?

But where do you get all these facts?

Easy. Take advantage of the free technical service provided by the National Coal Board and your Industrial Fuel Distributor. They've got all the answers when it comes to boilers, boiler installation, fuel and fuel costs. They know what's happening now and what's likely to happen tomorrow. Ready and waiting with sound, objective advice that will help you make the most efficient use of your fuel.

Just ring 01-235 2020, ext. 290 or consult your Industrial Fuel Distributor.

NCB Technical Service

Save your energy – leave it to us.

SAVE IT

Energy sense is common sense.

'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)

UK ISSN 0046–7960

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
July 1975

The Journal of The Institute of Hospital Engineering

Contents

Front cover: Use of convex mirrors helps staff to see around corners at Grove End Park Hospital, London (photo: Volumatic Ltd.)

We regret that publication of this issue has been delayed owing to an industrial dispute at the printers.

HE
Hospital Engineering
Vol. 29
July 1975

Institute 8th Annual General Meeting

Postgraduate Medical Centre, Bournemouth 25th April 1975

The President Dr. B. G. B. Lucas presided.

Council Report and Financial Accounts

The report of the auditors was accepted, and the report of Council and the audited accounts of the Institute for the year ended 31st December 1974 were received and adopted.

Elections to Council

The President confirmed that in accordance with the Articles of Association the following members of Council retire at the conclusion of this Annual General Meeting:

R. G. Freestone	Area Member, East Anglia & East Midlands
D. H. Mellows	Area Member, North West
P. Jackson	Area Member, Wales
B. A. Hermon	General Member
K. W. Wilson	Nominated Member

The President announced that the following being the sole nominees in their respective categories were elected to Council unopposed:

R. G. Freestone	Area Member, East Anglia & East Midlands
D. H. Mellows	Area Member, North West
P. Jackson	Area Member, Wales
K. W. Wilson	Nominated Member.

The President then called upon the Secretary to open the sealed envelope containing the auditor's letter giving the result of the ballot for the election of a General Member of Council. The Secretary opened the sealed envelope and read the letter therein which announced that B. A. Hermon was the successful candidate.

Special Business

The President proposed, on behalf of Council, seconded by W. Carr, the following resolution as a special resolution:
'That the Articles of the Institute be altered by deleting regulation 23 and substituting therefore the following regulation:
'23 The rates of entrance fees and annual subsrciptions for the time being payable shall be determined by Council'. This was agreed unanimously.

Retiring President's remarks

Dr. Lucas explained that, as ever, he wished to be brief but he did wish to say 'thank you for having me' and to say that he had enjoyed very much his term of office and only hoped that his successor would achieve equal happiness in office. Dr. Lucas then invested his successor F. Hugh Howorth with the President's Jewel and installed him as President.

Incoming President's remarks

Mr. Howorth assured the meeting that he would use his best endeavours to further the interests of the Institute. He said that he would preside at all meetings of Council and attend as many meetings of Council committees as he found possible. Mr. Howorth expressed the hope that his tenure might see a period of innovation and spoke of his connection with,

and knowledge of, the Institute of Patentees & Inventors. In conclusion, Mr. Howorth again committed himself to furthering the progress of the Institute.

Vote of thanks

Mr. B. A. Hermon said that he was quite sure that everyone would wish to associate himself with an expression of deep appreciation for the contribution of Dr. Lucas over the past two years. Mr. Hermon said that from the time of Incorporation on 1st January, 1967 the Institute had consciously turned from the image of the boilerhouse to a more professional approach and to embracing an ever widening discipline, including medical engineering. He felt that this quite deliberate move had been greatly accelerated during Dr. Lucas' term as President. As a member of Council and chairman of two Council committees he had been, personally greatly stimulated by the input and contributions from Dr. Lucas.

The meeting warmly endorsed the vote of thanks.

New members

Applications for membership have resulted in the following elections:

Fellows

Allen, N. C.	Hereford	*F. C. Foreman & Partners*
Body, R. S.	London	*DHSS*
Brookes, W. R.	Liverpool	*Mersey RHA*
Fryer, E.	Leeds	*Leeds AHA (T)*
Gordon, P. G.	Huddersfield	*Kirklees AHA*
Hanlon, K. G.	Cardiff	*W. S. Atkins & Partners*
Hemes, J. M.	Leicester	*Leicester AHA (T)*
Packer, J. B.	Harpenden	*Oscar Faber & Partners*

Members

Binnie, C. R.	Alloa	*Forth Valley Health Board*
Boulter, J. G.	Devonport	*Devon AHA*
Burrows, J. G.	St. Helens	*St. Helens & Knowsley AHA*
Clayton, L. W.	Wigan	*Bradshaw, Gass & Hope*
Cornwall, R. P.	Windsor	*E. G. Phillips Son & Partners*
Curwen, D.	Lancaster	*Lancashire AHA*
Dives, P. H.	Thornton Heath	*National Heart & Chest Hospitals*
Doe, F. C. D.	London	*Enfield & Haringey AHA*
Donaldson, C. R. A.	Exeter	*Communications Associates Ltd.*
Duckworth, J.	Wigan	*Wigan AHA*
Dutton, G. R.	Reading	*Berkshire AHA*
Earnshaw, A.	London	*Merton, Sutton & Wandsworth AHA (T)*
Emerson, R.	Birmingham	*Birmingham AHA (T)*
Fielding, J. R.	Leeds	*Leeds AHA (T)*
Gifford, G. R.	Longstanton	*Cambridgshire AHA(T)*
Haslam, G. J.	Sheffield	*BOC Ltd.*
Holyhead, R. A.	Chatham	*Kent AHA*
Hunter, J. G.	Scunthorpe	*Humberside AHA*
Ingram, A. N.	Dublin	*Varming, Mulcahy, Reilly & Associates*
Jackson, J. D.	Nottingham	*E. G. Phillips Son & Partners*
Jerred, H. V.	Bewdley	*West Midlands RHA*
Jones, M.	Bridgend	*Mid-Glamorgan AHA*
Karmali, S. A.	Nairobi	*HM The Aga Khan Platinum Jubilee Hospital*
King, O. R.	Portsmouth	*Wessex RHA*
Langford, E. G.	Portsmouth	*Hampshire AHA (T)*
Le Breton, C. P.	Norwich	*Norfolk AHA*
Lovell, M. J.	Bristol	*Avon AHA (T)*
Lyseight, N. O.	Dudley	*Dudley AHA*
Morris, C. J.	Salford	*Salford AHA*
Newman, R. W.	Colchester	*Essex AHA*
Osborne, J.	Edinburgh	*Ian Hunter & Partners*
Pikuda, G. O.	Lagos	*University of Lagos College of Medicine*
Pledger, H. A.	Hoddesdon	*Enfield & Haringey AHA*
Pracy, J. W.	Basildon	*London Hospital*
Rayner, G. J.	London	*University College Hospital*
Robinson, J.	Darlington	*Spirax-Sarco Ltd.*
Sedwell, P.	Braintree	*Essex AHA*
Stuart, M. L.	Edinburgh	*Scottish Health Service Common Services Agency*
Thompson, D.	Carlisle	*Northern RHA*
Waller, D.	Barnsley	*BOC Ltd.*
Wenyon, J.	Southampton	*Hampshire AHA (T)*
Wilkinson, P. R.	Barnsley	*Barnsley AHA*
Williams, W. J.	Lancaster	*Lancashire AHA*
Wootton, A. J.	Knebworth	*The Incinerator Co. Ltd.*
Yarnell, R. A.	Fishbourne	*West Sussex AHA*

Graduates

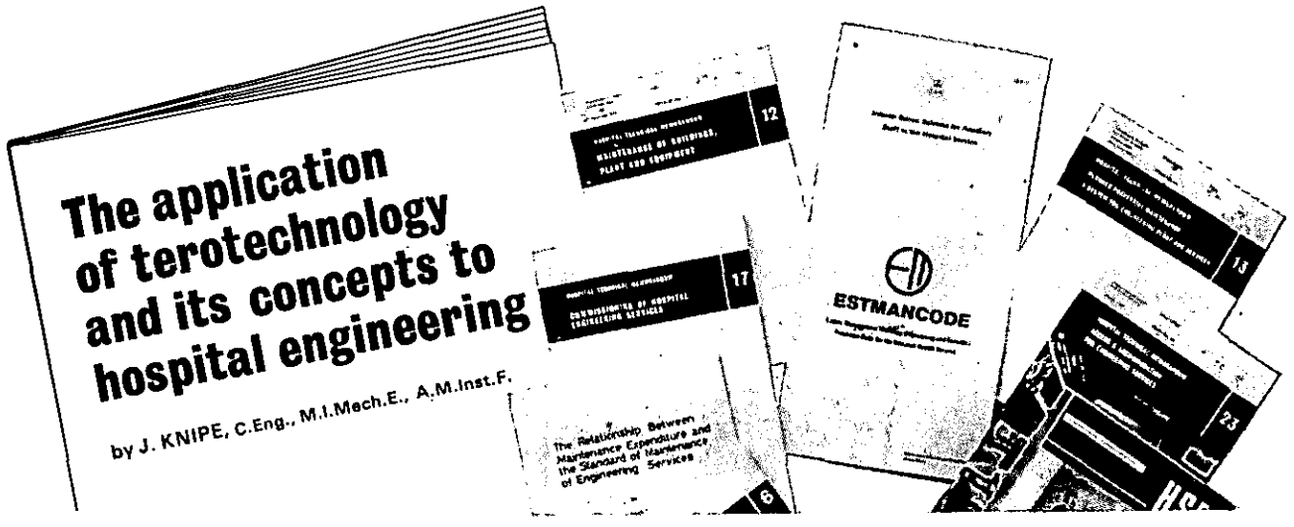
Andrews, T. J.	Aylesbury	*Buckinghamshire AHA*
Bangs, W. R.	Stanmore	*RNO Hospital, Stanmore*
Barrett, K. J.	Portsmouth	*Hampshire AHA*
Bebb, D. J.	London	*St. John's Hospital for Diseases of the Skin*
Birch, D. K.	Bracknell	*Berkshire AHA*
Bragg, D. J.	Cardiff	*South Glamorgan AHA (T)*
Fletcher, P. K.	Kingswinford	*Dudley AHA*
Meatyard, T. J.	London	*Royal Free Hospital*
Midgley, S.	Watford	*Hertfordshire AHA*
Prudence, M. T.	Woodford Green	*Redbridge & Waltham Forest AHA*
Ronaasen, D. A.	Cape Town	*M. J. Lewis & Partners*
Thomas, A.	Coventry	*Coventry AHA*

Associates

Al-Chalabi, I. A. J.	London	*Revall Hayward & Partners*
Brady, E.	Orpington	*South East Thames RHA*
Du Toit, G. A.	Cape Town	*K. F. D. Wilkinson & Partners*
Goldfinch, D. A.	Uxbridge	*Donald A. Goldfinch Associates*
Kay, H.	Southampton	*G. H. Buckle & Partners*
MacKenzie, J. N.	Inverness	*Scotish Health Service Common Services Agency*
Macrdechian, G.	Penarth	*Wallace Evans & Partners*
Nicholas, W.	Ipswich	*Suffolk AHA*
Witt, M. H. T.	Germany	*MoD (Army)*

Affiliates

Marpaul Heating Co Ltd.	London



1 Introduction

In England all but a few hospitals are wholly state-controlled and financed, so the costs of the services provided by the state cannot be suitably compared with the few private hospitals which exist since no form of competition is present. Further, when hospital cost comparisions are sought internationally, differing factors make viable relationships unrealistic. Within industry comparison between similar organisations is possible since the efficiency with which indirect engineering costs are controlled can be seen by their effect upon product cost and profitability.

In accepting the foregoing, the Engineering Division of the Department of Health & Social Security appreciated the need of not only devising systems to improve the organisation of the hospital-engineering function but also the means of examining their effectiveness. Further, it was realised that each system must not only be effective in itself but must be supported by an overall concept aimed at providing the greatest possible value for the monies to be spent. To this end the functional system set out in Fig. 1 was brought into being.

The importance of such a system can be understood in the knowledge that the present replacement value of buildings, plant and equipment at existing price levels is of the order of £3750 million; plant and equipment being £1100 million of this total.

Since the hospital service became a complete entity in 1948, building and engineering capital expenditure has exceeded £1275 million, while the present annual expenditure to maintain the whole is £80 million, of which, £40 million is spent upon the mechanical and electrical installations. Figs. 2 and 3 show the annual expenditure in 'actual' and 'real' value money terms since 1949/50.

Parallel with the introduction of the concept of efficient hospital-engineering management (Fig. 1), the government departments that are responsible for trade and industry set up a committee to examine the costs of all forms of maintenance in industry and to consider means by which such expenditure could be made more effective.

Arising from this, the committee reported that a new technology was required which could provide effective means for communication and collaboration between experts at all levels in an organisation and a continuous feedback of information to all those who contribute to optimising the life-cycle performance of physical assets. The committee derived the word 'terotechnology' by adding the Greek word tero (I maintain) to technology.

2 Definition of terotechnology

Terotechnology is a combination of management, financial, engineering and other practices applied to physical assets in pursuit of economic life-cycle costs.

Note: Its practice is concerned with the specification and design for reliability and maintainability of plant, machinery, equipment, buildings and structures, with their installation, commissioning, maintenance, modification and replacement, and with feedback of information on design, performance and costs.

3 A systems approach to overall management

Within industry, engineering management and those responsible for financing the requirements of engineering functions have for long appreciated the need to ensure that full-value must be obtained from expenditure on a service which in itself is unprofitable in the sense that it does not add to the value of the goods produced but is in fact a charge on manufacturing costs and can therefore affect profits.

Arising out of this, many systems of control have been devised and used in efforts to reduce maintenance costs, while endeavouring to increase output per unit of machine life and reduce capital costs on new plant and buildings. In exercising such systems of control those responsible have tended to use well tried and documented methods and applied them in a manner that appeared to best meet their individual needs.

Mr. Knipe is with the Department of Health & Social Security, Euston Tower, 286 Euston Road, London NW1 3DN

This article is based on a paper presented by Mr. Knipe at the 3rd International Congress of Hospital Engineering, Athens, Greece, May 1974

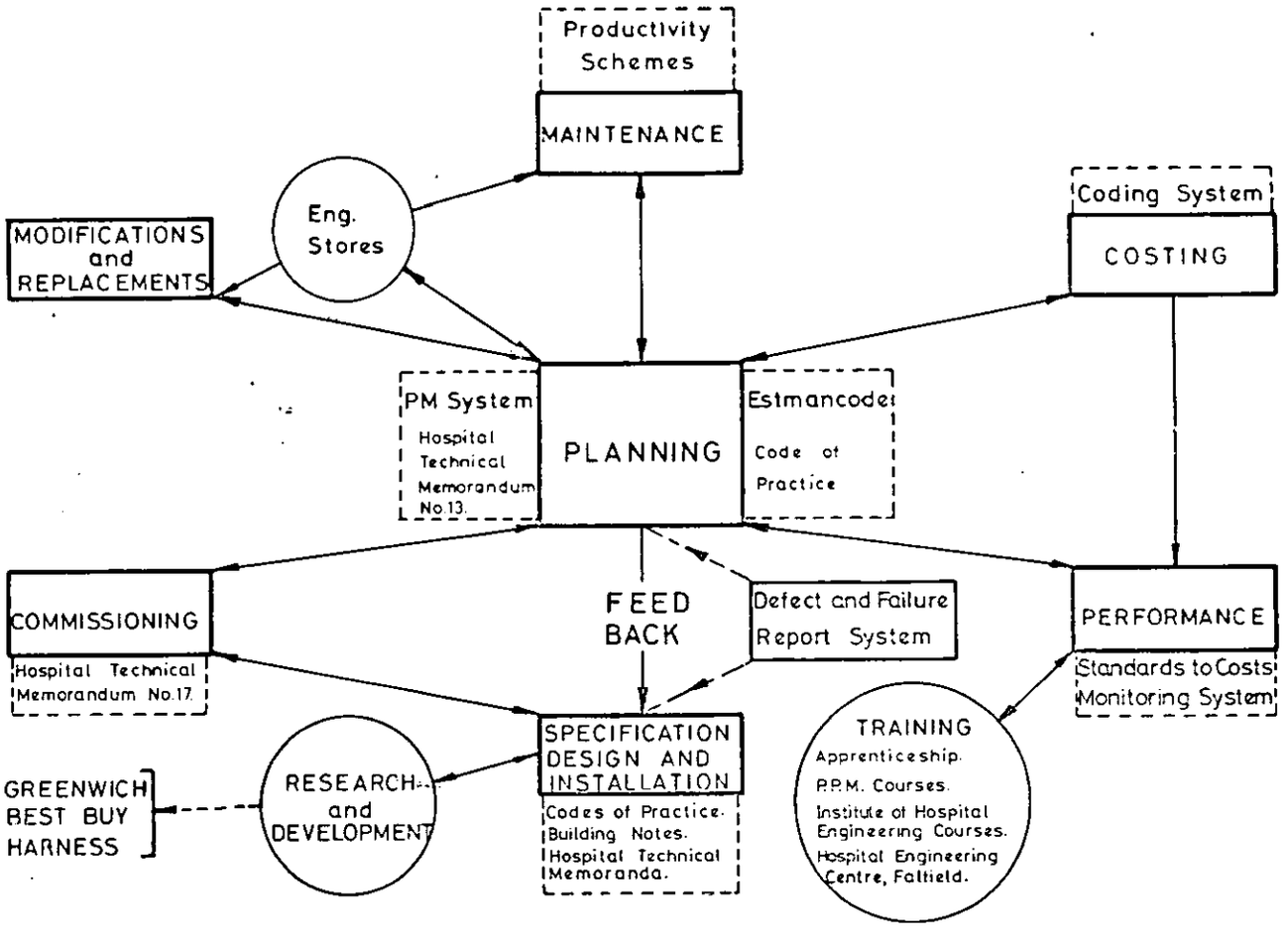


Fig. 1 Terotechnology application to hospital engineering

It will be clear therefore that the concept of terotechnology introduces a more comprehensive approach to the problems of reliability, efficiency and full utilisation of plant, equipment and buildings; it can be seen as embracing modern management techniques as well as the many long established engineering disciplines.

For example, the designer with his specialised knowledge has the right to make any decision necessary in his own field, while those responsible for installing, commissioning and maintaining must provide all the information necessary to ensure reliability, ease of access and maintainability and therefore the right to examine all aspects of design before acceptance. Parallel with this, those responsible for production and its costs must be able to specify the cost and performance of the equipment they require and to control their area of responsibility in a manner best suited to current policy and future change.

There is little doubt that the application of such an approach can go far towards lowering maintenance costs while at the same time having the effect ultimately of providing buildings, plant and equipment requiring less and less maintenance, either through designing out the need for maintenance or deliberately designing for short-term working life and early obsolescence.

It will be patent that terotechnology used as an overall discipline, irrespective of whether it is applied to plant and equipment or to buildings, can produce economic life-cycle costs.

It must not, however, be overlooked that, with any system making full use of information derived from various sources and from differing levels of managerial ability and outlook, there is an inherent risk that the acquisition and exchange of data will be the main basis for decisionmaking and the real causes of failure of plant and equipment or of high costs in its operation and maintenance may be obscured.

If terotechnology is to be practised successfully, diagnosis must be constantly applied by those of suitable competency and the failures and trends noted and the information used to continuously improve management at every level.

Additionally, where the necessity to employ systems providing a means to ensure economic life-cycle costs is paramount, as in the hospital service, where, in many cases high-cost equipment is infrequently used, the overall concept ought to be one which somewhere along the line also asks the question: 'should maintenance be necessary at all?'. The answer to such a question may be that some maintenance is unavoidable and, if this is so, it is relevant to inquire if the existing approach is correct or should con-

sideration be given to other and better ways of dealing with the problems of maintainability.

Maintainability can be seen as the application of a discipline leading to the design and development of systems and equipment that can be maintained in the least possible time at the lowest possible cost and with a minimum expenditure of support resources without adversely affecting performance or safety.

Basically, planned preventive maintenance systems are simple to set up and use, being inherently suitable for the provision of instructions covering a predetermined action at preset dates.

It is also by virtue of their simplicity that they can and are frequently misused unless great care is exercised to ensure continuous perusal of the records provided by them. Without regular appraisal of these records, followed by suitable action when necessary, an existing asset may continue to be inspected at the same frequency and/or remain in service independently of its need or real value in its present form or design. This may arise where the existing use has changed substantially in relation to the original need or the frequency of use differs greatly from that at the time the original planned preventive maintenance system was set up.

Where a decision is made that an asset shall have a limited life based upon usage and all the steps necessary to make a replacement available have been taken, care will have to be exercised to ensure that such a decision is ultimately reviewed before replacement is finally made. Under these circumstances minimum records only are necessary and would only be extended as required to cover the information needed to reach a decision.

It ought to be the primary aim of management to eliminate maintenance wherever economically possible and not simply to build a complex system for carrying out more and more maintenance.

This is made possible by the correct use of commissioning in association with planned preventive maintenance and feedback procedures and constant reference to the detailed records and information they are capable of providing. For example:

(*a*) Tribology studies have been particularly successful in designing out the need to lubricate in many instances.

(*b*) Changes in materials of construction have frequently lowered maintenance costs substantially and in many instances eliminated the need to maintain, and, although capital costs may be increased, they are a once and for all charge and this is important, particularly in an inflationary era.

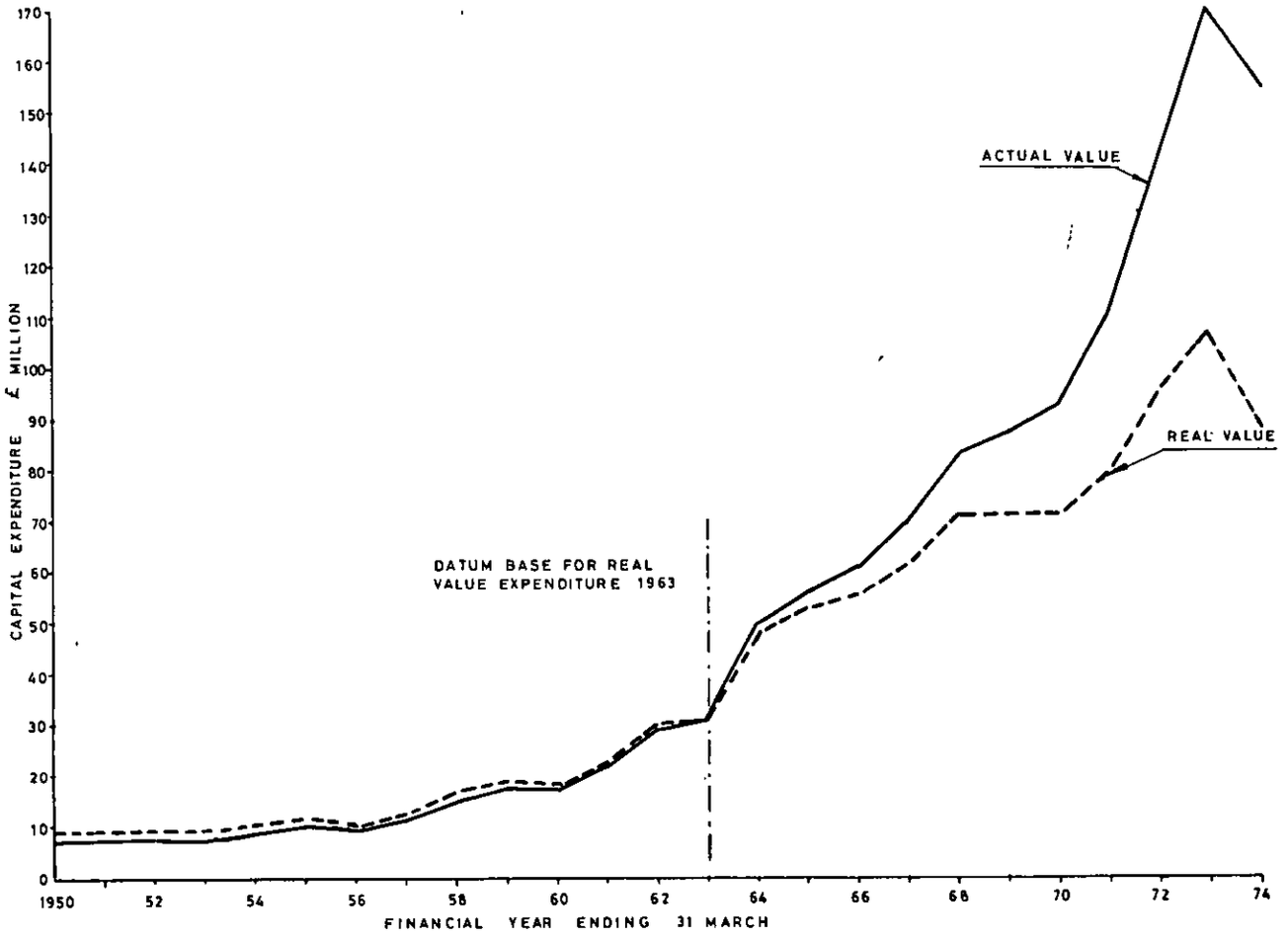
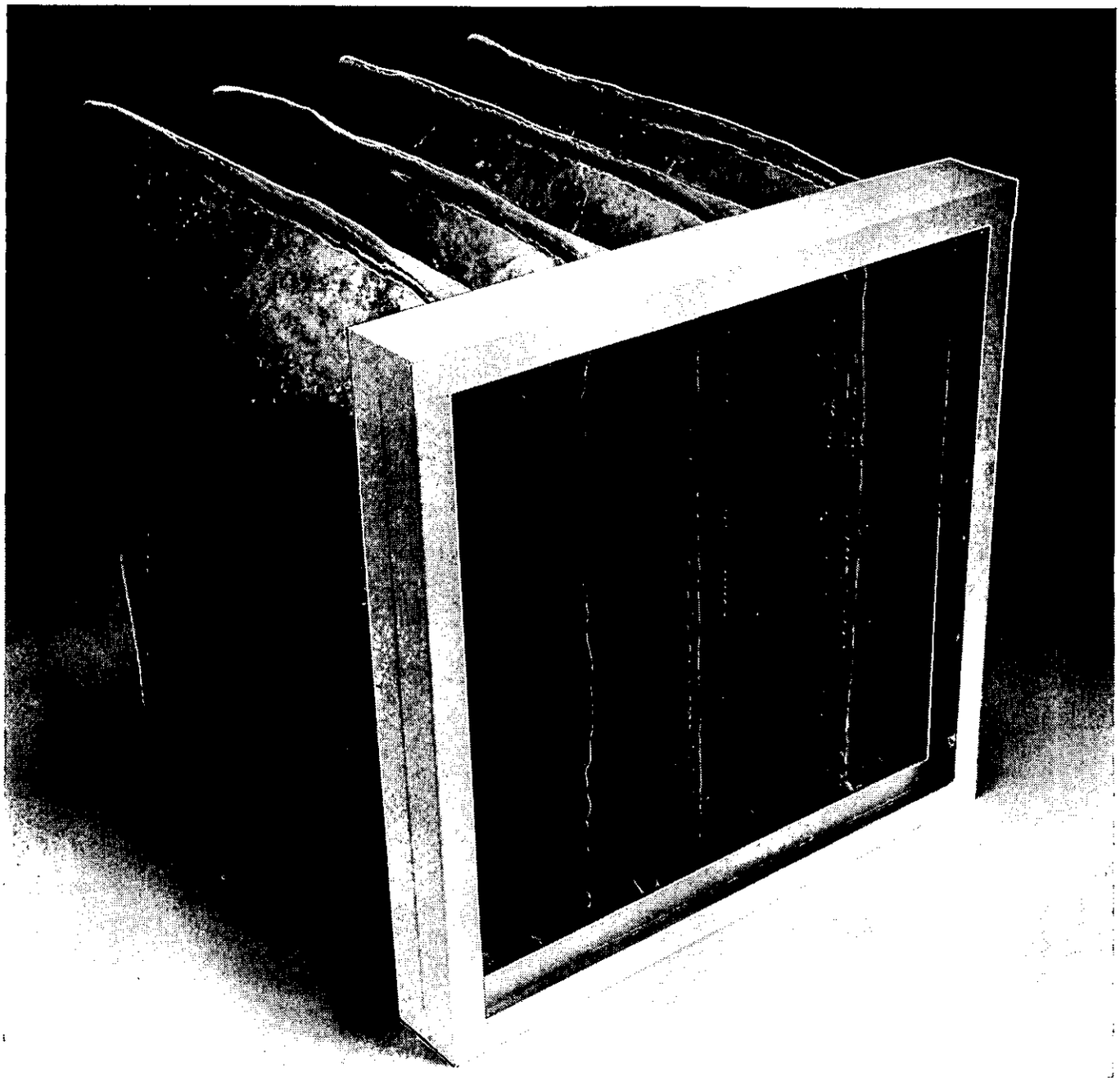


Fig. 2 Building and engineering capital expenditure on new buildings and conversions (England) in actual and real-value terms



Moneybags!

The new Vokes Univee 2 range is a breakthrough in bag filters and a significant advance in efficiency combined with low cost.

Vokes research has developed composite bags which can hold so much dirt that in most applications they rule out the need for pre-filters, saving space and saving money.

This new system supersedes the conventional method of two-stage air filtration which has to employ the much more costly arrangement of panel or roll filters followed by bag filters.

Designed for front or side withdrawal, these multi-layer bags achieve exceptional dust holding capacity for given efficiency and air volume requirements. The result is that increase in pressure loss is at a much slower rate than with conventional bag filters.

All of which adds up to longer life, less servicing and a great saving in costs.

That's why we call the new Vokes Univee 2 filters 'Moneybags'.

VOKES FILTERS

A member of the Thomas Tilling Group.

Vokes Air Filters Limited, Henley Park, Guildford, Surrey GU3 2AF. Telephone: Guildford (0483) 69971.
Branches at London, Glasgow, Burnley, Birmingham, Belfast and Dublin.

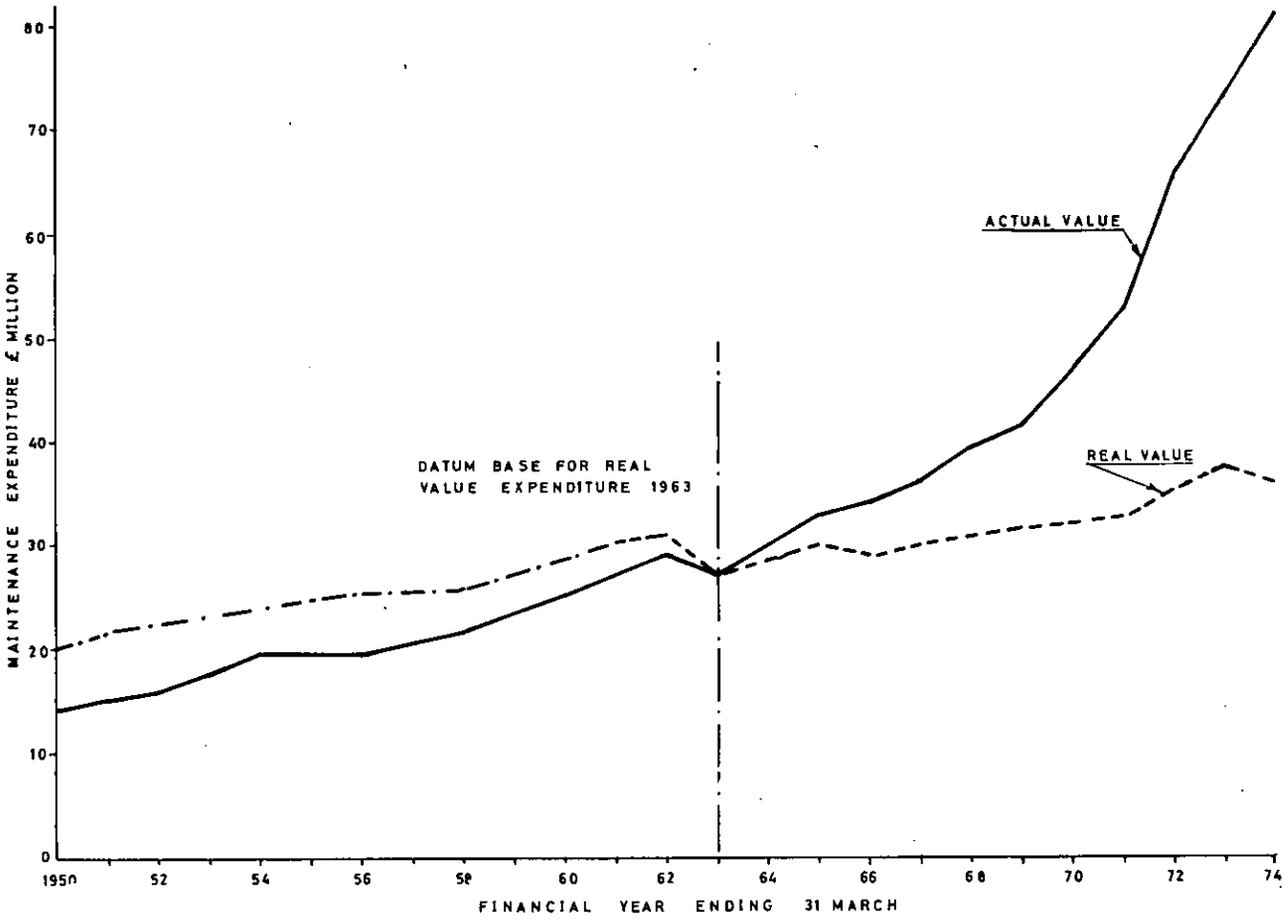


Fig. 3 Building and engineering maintenance expenditure (England) in actual and real terms

(*c*) A coat of paint will have the same application cost whatever its value as a means of protection.

(*d*) Ergonomic studies have had a wide impact in many fields, producing designs enabling plant and equipment to be more easily used and thereby reducing the effects of misuse, but additionally providing information covering access and easing of work tasks both for the operator and for the maintenance engineer. Accessibility for maintenance is too often overlooked when assessing what may be required to either eliminate or substantially reduce maintenance costs.

(*e*) Accessibility for maintenance together with, or allied to, the designing out of maintenance is obviously a matter of compromise, since designer or manufacturer will not start off by producing equipment solely to provide employment for maintenance staff.[1]

A log of plant design and operational faults would be a powerful aid in designing out maintenance but it is seldom available when attempts are made to persuade designers and manufacturers to do something positive about a particular problem. It is only in rare instances that sufficient weight of evidence is available to make any real impact on those responsible for the supply of equipment etc.

Design engineers and architects usually know little about the problems of maintenance, and manufacturers of plant and equipment are too often unwilling to make design changes because of the adverse effect on their competitiveness.

4 Application of terotechnology to hospital engineering

A first step toward the functional system (Fig. 1) was the preparation and setting up of a planned preventive maintenance organisation suitable to meet the needs of engineering installations generally to be found in hospitals.[2]

Initially it was considered that its main function was to keep plant and its associated services in good operating condition at all times and parallel with this obtain the benefits associated with an even spread of engineering-maintenance workload and more positive information of staffing requirements. Further benefits were anticipated from fewer emergency situations arising from breakdowns and also from an extension of the working life of plant; the frequency of action and details of work to be carried out on the engineering plant and equipment were related to an annual programme.

While initially the detailed costs arising from these

Table 1. Application of terotechnology to hospital engineering

Resulting benefits	Procedures leading to management effectiveness						
	Planned preventive maintenance	Productivity	Cost coding	Monitoring	Commissioning	Training	Codes of practice manuals
Extended plant life	✓				✓	✓	
Feedback and information service	✓		✓	✓	✓		✓
Reduced downtime	✓	✓			✓	✓	
Improved reliability	✓				✓	✓	
Improved quality of work				✓	✓	✓	✓
Overall performance	✓	✓	✓	✓	✓	✓	✓
Improved plant/equipment design	✓			✓	✓	✓	
Cost consciousness	✓	✓	✓	✓	✓	✓	✓
Preparation of budgets			✓	✓			✓
Controls							
Direct costs	✓	✓	✓	✓			✓
Indirect costs			✓	✓			✓
Incentive schemes	✓	✓	✓	✓			

actions and any consequent repairs or renewals were not considered necessary, it became obvious that a system to provide such detailed cost information would be required so that comparisons could be drawn between the maintenance costs of differing types of equipment providing the same facility, such as sterilisers, boilers etc. and ultimately to compare one hospital with another.

Through a system of cost coding and the availability of the computer it is now possible to produce all of the basic information leading to economic life-cycle costs. Where, as in hospitals, the engineer directly responsible for maintenance is to a large extent divorced from the designer of new schemes, great care must be exercised to ensure that the latter does not work in a vacuum. The design engineer under these circumstances finds himself beset on two sides, on one hand by the user and on the other by the manufacturer of the plant and equipment. If he is to complete his task satisfactorily he must be provided with every assistance by way of detailed and reliable information to enable him to make correct decisions; whereas he may have an overall knowledge of requirements he will not always have the detailed information of actual site conditions covering access, environment etc. to allow the best solution to be arrived at, unless this also is suitably documented.

While feedback from the user via planned-preventive-maintenance records forms a vital link, through its ability to provide information covering plant equipment already in use, it has too often been seen that the behaviour of such plant has been affected by the manner in which its original installation was carried out or that its ability to provide the service for which it was designed and installed could not be met for one reason or another. For example:

(*a*) inadequate specification

(*b*) failure to meet specification requirements

(*c*) unsuitable environment

(*d*) lack of tests either by manufacturers and/or on site.

As a further function in the overall concept of terotechnology the Engineering Division of the Department of Health set up in 1966 a working party to consider all the aspects associated with a system of commissioning.[3]

In the overall operation of such a system it should be appreciated from the outset that the Department of Health & Social Security does not accept that commissioning of plant and the testing of equipment both at the manufacturer's premises and/or following its installation should conform wholly to the practices normally accepted, in general, by industry. Emphasis is placed upon commissioning as a means of establishing that the 'design intent' has been met, together with a final stage of test and acceptance by the user. The last part of the programme should include any onsite training of the user (operative) and the staff responsible for its maintenance, together with the

provision of charts, drawings and operating instructions.

These three tools—planned preventive maintenance, cost coding and commissioning—cannot be considered in isolation. Of greater importance is their overall effectiveness in providing the standards of maintenance management necessary to produce economic life-cycle costs.

It was seen necessary therefore to advise some means by which these maintenance standards could be measured and, at the same time compare them in similar hospitals while showing their relation to the overall costs of providing that standard. Fig. 1 shows under 'performance' the part it plays in terotechnology.

It can be seen that, to meet the application of terotechnology to hospital engineering and thereby provide economic life-cycle costs in respect of its assets, the procedures leading to management effectiveness had to be established and these and the resulting benefits are summarised in Table 1.

5 Planned preventive maintenance[2]

Planned-preventive-maintenance systems have long been established as a means of organising maintenance work. The records resulting from such systems have provided information on the condition and behaviour of plant and equipment in a variety of environments. These records, by showing the incidence of breakdown, can determine the optimum frequency of maintenance visits or the need to redesign/renew components with a high failure rate.

The DHSS system adopts the basic functions of examining, testing and checking which are defined in the maintenance manuals. The whole scheme is described in detail in a Hospital Technical Memorandum. Incorporated is a simple work docket for the inspecting staff which indicates the location and maintenance task to be performed in accordance with a predetermined programme.

The usual practice is that the inspector reports in writing on the conditions he finds and only carries out minor adjustments at the time of the inspection. However, where conditions require emergency action this will be undertaken by the inspector. The written instructions to the inspector, other than in exceptional cases, are confined to the carrying out of tasks set out in mechanical and electrical maintenance manuals which detail the type of plant and equipment and the action to be taken at a prescribed frequency.

It is found, in general, that while this system goes far towards avoiding breakdown conditions and in providing information suitable for the preparation of future workloads, it is too often operated as a separate function of day-to-day maintenance and not seen as part of the overall maintenance organisation.

Additionally it is frequently the case that, beyond marking the master plan, no records are kept of planned preventive maintenance or of any other general maintenance work carried out on a unit independently of the planned preventive system. Where records do exist, they are seldom, if ever, accompanied by details of the work carried out or its cost.

Without suitable records showing what work is necessary, the repair or modification carried out, together with the dates of completion, it is impossible to provide information which would allow the behaviour or suitability of the plant installed to be considered.

Additionally, without cost information covering orginal value, costs of repairs over any period of use, a cost over its life review leading to a firm decision regarding its suitability in use could not be provided.

Finally, an important aspect of the engineer/building supervisor's management is at all times to ensure that his task force is economically deployed. Without accurate and reasonably detailed records kept under constant examination this is not possible and too often labour continues to carry out unnecessary and uncoordinated tasks.

It will be seen therefore that, if planned preventive maintenance is to play its full part in the overall system, then feedback information must be provided, based upon records both of work and its costs, all associated with differing types of plant and equipment.

The present position regarding the operation of planned preventive maintenance is that approximately 50% of the installed engineering plant and equipment in hospitals throughout England is covered by this system.

Much of the difficulty associated with the collection of viable maintenance costs has arisen from the the original fragmenting of the hospital service, aggravated by the need to produce masses of information at hospital department level. This has prevented full consideration being given to the high running costs with which the hospital service is involved, but much has been done in overcoming these difficulties and a system of cost coding has now been established.

6 Monitoring—maintenance standards in relation to their costs[4,5]

Two important management problems exist in the health service covering control of expenditure associated with the maintenance of buildings, plant and equipment when related to industrial undertakings. First, in general, it is not possible to evaluate this expenditure in the light of its effects upon the cost of the product or service provided, or how much can be spent in relation to machine downtime and of its effects upon production costs and ultimately the profits on the capital invested. Secondly, for reasons of increased productivity and lower manufacturing costs, industry may be prepared and able to set a firm cost per unit of product on a machine's capital and maintenance costs and thereby have a yardstick by which replacement and/or obsolescence can be controlled. This cannot be provided for in hospitals, apart from such units as laundries, central sterile supplies departments and boiler plants.

If an evaluation of the economic life cycle of hospital assets is to be made, it will be through the provision of soundly based and viable measurements and records; further, such an evaluation will go far to ensuring that the allocation of monies for maintenance purposes and/or plant replacement is of the right order.

Apart from the records available from fully documented planned-preventive maintenance systems, it has hitherto only been possible to relate expenditure on maintenance to hospital type and size on a broad basis, the system of allocation being the cost according to building volume.

This method was based originally on the assumption that the largest items of maintenance costs were in direct proportion to building volume, since generally engineering installations consisted essentially of unsophisticated heat-radiation and heat-producing plant. The heating installation was sized in accordance with building volume while the production plant also supplied the catering department and was associated therefore with the number of beds and hence building volume. Where laundry steam requirements had to be met from larger producers of heat, suitable allowances were made.

These relationships to expenditure can no longer be considered as satisfactory, particularly when it will be seen from the details set out in the introduction that engineering plant and equipment installed in modern and updated hospitals has increased enormously in volume and complexity as the demand for more sophisticated equipment and improved environmental conditions has arisen.

Parallel with the need to provide an overall method of establishing the maintenance cost of engineering services in hospital departments for each type and size of hospital, it was necessary to provide a means of measuring management efficiency to ensure that a value had been obtained from the money spent.

In 1971/72, coding and recording of maintenance expenditure was instituted and results are continuing to be analysed based on the information returned, (Table 2)[5]. Together with this, a system has been, devised enabling measurements of the standard of engineering maintenance within hospitals to be undertaken.

Arising out of these two sets of information it was possible to relate maintenance expenditure to the maintenance standard achieved.[4-6]

The system utilises an arbitrary overall maintenance standard of 80% for a complete hospital as the acceptable level of achievement. Hospitals rated above 85% are considered to be providing a standard of maintenance greater than economically desirable, while assessments of less than 75% imply that the standard is below acceptable levels (Fig. 4).

7 Commissioning

Reference to Fig. 1 will show that the DHSS Engineering Division found it necessary to provide a technical memorandum on plant commissioning.

Table 2. Format of secondary code for engineering expenditure

Secondary Code	Element	Annual expenditure: Pay	Materials	Contracts	Total
	Mechanical services				
081	Cold-water services				
082	Hot-water services				
083	Space heating				
084	Heat distribution				
085	Fire fighting				
086	Air conditiong and ventilation				
087	Gas services				
088	Medical gases				
089	Compressed air				
	Total				
	Electrical services				
091	Power				
092	Lighting circuits				
093	Lighting fittings				
094	Emergency supply				
095	Communication				
096					
	Total				
	Heat source				
101	Steam boilers				
102	H.P.H.W. boilers				
103	M.P.H.W.				
104	L.P.H.W. boilers				
105	Miscellaneous boilers				
	Total				

Secondary Code	Element	Annual expenditure: Pay	Materials	Contracts	Total
	Plant and equipment				
111	Medical equipment				
112	Catering equipment				
113	Laundry equipment				
114	Sterilising equipment				
	TOTAL				
	Minor new works (alterations and improvements)				
141	Building				
142	Engineering				
	Total				
	Tools and consumables				
151	Building				
152	Engineering				
	Total				
	Domestic repairs				
161	Building				
162	Engineering				
	Total				
	Supervision				
011	Building				
012	Engineering				
	Total				

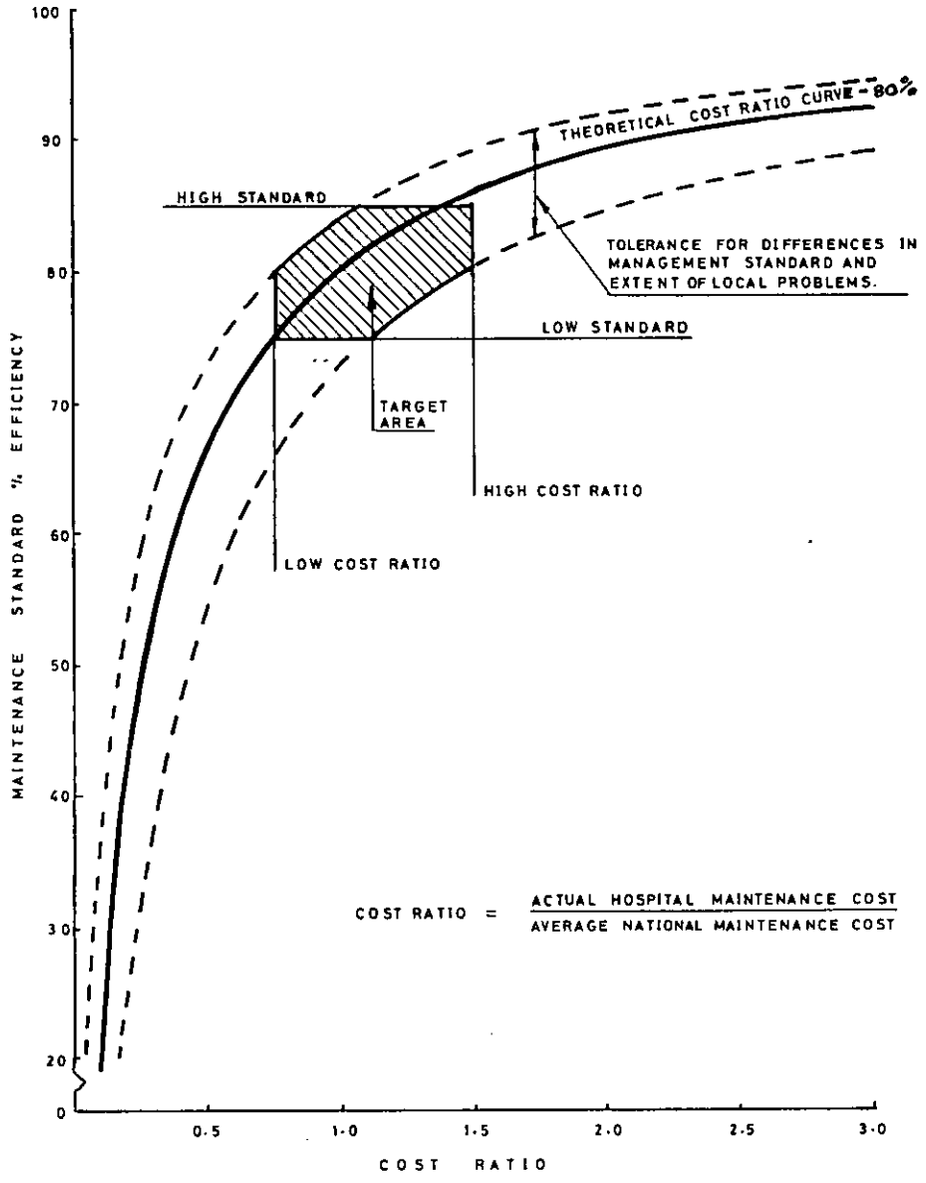


Fig. 4 Typical form of maintenance—standard/cost ratio

This arose because of inherent shortcomings of plant commissioning in that the then normally accepted practices fell short of the requirements of a fully integrated system having the concepts of terotechnology.

The previously accepted practices involved comparatively simple tasks to ensure that plant and equipment were installed and services provided in line with very broad specifications and line diagrams only, the responsibility for the day-to-day inspections being in the hands of a site engineer employed by, and responsible to, the consulting engineer through a clerk of works.

The most important exclusion was the details of 'design intent' and the specifications associated with it or any documentation showing how or why such specifications or method of installation had been determined. It will be obvious from this that any later attempts at checking on performance following repair or for examination of unsatisfactory behaviour were impossible.

An examination of the Hospital Technical Memorandum will show that the procedures now adopted place emphasis upon an assurance that the design intent has been fully met and that the relevant information likely to be required during the working life of the plant and equipment installed is handed over to the maintenance engineer.

It is intended that such methods of commissioning should apply to all forms of new installations irrespective of size or costs.

At this time 16 separate commissioning manuals have been produced and these cover all the major items or groups of plant and equipment normally to be found in modern hospitals.

Such a detailed method will ensure that the plant and equipment is correctly installed and tested while at the same time providing facilities for inservice

monitoring, thereby establishing that the 'design intent' is at all times being met. At present no accurate knowledge of the separate costs of commissioning are available but it is believed that approximately 0·50% of the total engineering capital cost should be set aside for this purpose.

An acceptance of the concept of terotechnology implies also an acceptance of the necessity to provide for the setting up of any system having as its object not only a completely satisfactory installation at the onset but also the means by which all subsequent behaviour may be measured. This is of course additional to the necessity to ultimately design out maintenance through the feedback of information to the designer and manufacturer.

8 General

8.1 Personnel training

While the sections leading up to this part of the article have set out the philosophy of efficient management and the methods adopted in the hospital service to apply this in detail, it should be understood that the practices must be willingly accepted by all concerned to achieve the best results from the resources employed.

This in turn implies that, where either the necessary ability or knowledge is in doubt, steps should be taken to both train personnel and provide the opportunity of applying newly acquired skills.

As reinforcement of this the DHSS has provided an establishment for training and informing existing personnel and new entrants with the objects of providing for:

(*a*) Engineers in the hospital service:
- (i) a detailed knowledge of available equipment of suitable design
- (ii) a sound knowledge of overall design and layout for modern hospital practices
- (iii) the ability to clearly understand the association of the foregoing with commissioning
- (iv) the knowledge necessary to apply the systems of monitoring maintenance standards and costs
- (v) the available aids to effective management.

(*b*) Craftsmen in the hospital service:
- (i) a wider knowledge of fault diagnosis and correction covering mechanical, electrical and electronic equipment
- (ii) advancing and supplementing existing personal craft skills to produce multitrade abilities.

8.2 Extension of existing systems

The system of monitoring standards of maintenance and relating them to their costs is described in Section 5 and from this it will be noted that much work has been carried out to determine its practicability; this, however, has so far only been associated with assessing the maintenance standards of hospital departments in terms of the mechanical and electrical plant and equipment contained in them.

Further studies are in hand along similar lines to determine the standards of individual engineering services and relate these both to the costs of maintenance and to the original capital costs.

8.3 Management practices codes

As an overall guide the DHSS has from time to time issued manuals, memoranda and recommendations covering codes for management practices.

These have more recently been completely reviewed and now under the generic title, ESTMANCODE (Estate Management, Building, Engineering and Grounds), have set out one main Practices Code containing wide ranging guidance and recommendations for all those accountable for the management of the National Health Service Estate.

Each section provides procedural and financial guidance for professional, technical and general management including, where appropriate, procedures developed by other bodies in the public and private sectors.

9 Summary

Throughout this paper the endeavour has been to illustrate the value of the concept of terotechnology as a sound means of producing economic life-cycle costs of the assets of a large organisation.

Such a concept requires every member of the managerial organisation to play his individual part if the outcome is to be completely successful. Parallel with this, however, it can also be seen that only in the case of the engineer will it become essential to see terotechnology as a complete functional concept enabling him to provide in the most efficient and effective manner the support that overall management requires.

Nevertheless terotechnology is purely an organised and logical approach linking established practices rather than a technology in its own right.

From this it follows that there must be a wide acceptance of the need to develop at all levels an awareness of the shortcomings of existing management education from technicians to the professional engineers and managers plus the encouragement of the use of its principles in every way possible.

References

1 Hospital Technical Memorandum 23: *Access and accommodation for engineering services*, March 1972

2 Hospital Technical Memorandum 13: *Planned preventive maintenance: a system for engineering plant and services*, January 1965

3 Hospital Technical Memorandum 17: *Commissioning of hospital engineering services*, August 1967

4 Knipe, J.: 'Measuring engineering maintenance standards' 2nd International Congress of Hospital Engineering, 6–9th June 1972

5 KNIPE, J., and SKEGG, V. E.: 'The relationship between maintenance expenditure and the standard of maintenance of engineering services'. Paper presented to the Building Services Engineering Society, 12th December 1972

6 SKEGG, V. E.: National hospital service—maintenance cost data and its comparison with other published information'. 2nd International Congress of Hospital Engineering, 6th–9th June 1972

7 ESTMANCODE: estate management (building, engineering and grounds). Practices code for the National Health Service, Section 1, 24th October 1973

HE Product news

GAS CHLORINATORS

The Advance Series 800 cabinet-mounted gas chlorinators have been designed to provide safety, low maintenance, and reduction of floor space to meet the variety of chlorination requirements found in municipal and industrial water-treatment facilities. The cover can be removed to expose components for inspection or maintenance from the front of the unit, enabling the chlorinator to be mounted close to the wall without consideration of rear accessibility. The vacuum regulator can be remotely mounted at the chlorine supply, either directly on the chlorine cylinder or on a wall manifold in the chlorine storage aera. Should the vacuum line be broken or if the water supply to the ejector is interrupted and vacuum lost, the chlorinator will immediately shut off the flow of chlorine gas at the inlet to the vacuum regulator. The chlorinators are available in six chlorine gas flow meter ranges, up to 225 kg of chlorine per 24 h.

Capital Controls, Division of Dart Industries, Ltd., 20 Greens End, Woolwich, London SE18 6JY.

COMPACTORS

The Lescha range of compactors consists of three models. The 1·5 UT measures 63·5×45×58 cm, the 1·5 H 85×45×60 cm and the 1·7 de luxe 85×45×60 cm. The 1·7 de luxe achieves a pressure of 1·7 t, while the other models are designed to give a pressure of 1·5 t. The capacities vary from 20 litres to 25 litres and the prices range from £165 to £205.

Environco Ltd., Rampart House, Victoria Street, Windsor, Berks.

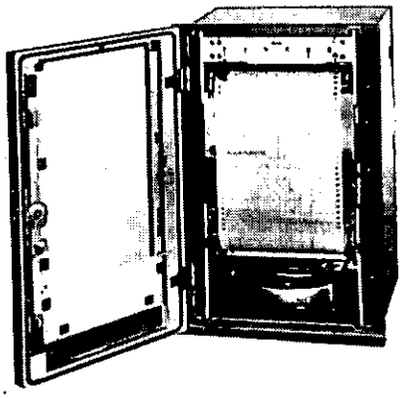
FIRE-ALARM SYSTEM

Of the 'open-circuit-monitored' type, the new Gent fire-alarm system uses the Gent 1163 indicator/control panel and is suitable for use with any Gent alarm initiating device including 'smash-glass' points, heat detectors and BRK smoke detectors of the single- or dual-gate type. With this system a small low-voltage alternating current is continuously applied to the initiating circuits to monitor lines so that any disconnection or line break will result in a fault signal. Upon any initiating point being operated, a relay in the indicator/control panel is energised to give a fire-zone signal and to set off the alarm sounders. Smoke detectors can be either included in the circuit initially or can be added at a late date. The system is designed for 24 V d.c. operation in conjunction with the a.c. monitoring supply and standard indicator/control panels are available in sizes to serve up to 18 alarm zones, but special panels to serve in excess of this number can also be supplied.

Gent & Co. Ltd., Faraday Works, Temple Road, Leicester LE5 4JF.

STRIP-CHART RECORDERS

These strip-chart recorders are available with one, two or three independent measuring systems, each driving a pen in a straight horizontal line across a 100 mm-wide chart. To drive the chart there is a choice of four mechanical spring clocks or three mains-powered electric clocks, giving a range of chart speeds from 1·25 to 7200 mm/h (mechanical) or from 5 to 14 400 mm/h (electric). The sensing elements are bellows, Bourdon tubes and helical springs for measuring low, medium and high pressures, respectively; and mercury-in-steel Bourdon elements for measuring temperatures. The smallest pressure range available is 250 mbar and the largest 1000 bar. There are also vacuum ranges and combined pressure and vacuum ranges. There are twenty temperature ranges available between −40 and +600°C. Single-element recorders for pressure or temperature are available in portable form for onsite investigations.



Bundenberg Gauge Co. Ltd., PO Box 5, Altringham, Cheshire WA14 4ER.

WASHING MACHINE

The Newamatic 9–300 has a washing area of 1 m² and will wash simultaneously four standard baskets of assorted glassware. The machine has a door at either end to enable operators to have a dirty and a clean washing arc. The washing program for the standard production machine is:

(*a*) hot or cold prerinse, automatic or manual control
(*b*) hot detergent wash at a controlled temperature (40–95°C) for 0–12 min
(*c*) fresh hot-water rinse at a controlled temperature (54–66°C) for 0–12 min
(*d*) distilled-water rinse for 0–12 min.

Special instructions for a steam sanitising rinse, an acid intermediate rinse and a disinfectant rinse are optional accessories.

Arnold R. Horwell Ltd., 2 Grangeway, Kilburn High Road, London NW6 2BP.

PHOTOELECTRIC SWITCH

The PBO–2403, 2406 and 2410 photoelectric switches consist of photoelectric cells complete with bimetal relays and mounted in waterproof housings. The cells monitor daylight conditions and when this falls to 70 lux (±15%) the relay operates to switch lights on. When the light level increases to 140 lux the relay opens and switches lights off. To prevent 'hunting' a 1 min time delay is incorporated in the circuit. The units are priced between £6 and £8 and are available with switching capacities between 3 A and 10 A.

Photain Controls Ltd., Unit 18, Hanger 3, The Aerodrome, Ford, Sussex.

Water treatment for the Middlesex Hospital

Amongst the more recent contracts awarded to Serck Water Processing has been the commission to design and supply a water treatment plant to the Middlesex Hospital, London, as part of their recent building of a new boiler house. The water is used for the general central heating and air conditioning plant, sterilisation, and domestic hot water.

The automatic water treatment plant is arranged as a single stream and comprises a dealkalisation ion-exchange unit, degassing equipment and a base exchange softener, producing dealkalised softened water feeding medium-pressure boilers.

The three most troublesome features of raw water normally encountered in boiler water treatment are:—

(*a*) *Total dissolved solids.* The amount of solids permitted in a boiler depends upon the design of the boiler, load, operating pressure, character of the dissolved and suspended solids and the amount of carryover that can be tolerated. Where the solids content of the feedwater is high it will require excessive blowdown to keep within the permitted solids content. This is obviously uneconomical.

(*b*) *Calcium and Magnesium salts* (hardness) cause scaling in the boiler with all its attendant problems when untreated water is heated.

(*c*) *Bicarbonate salts* (alkalinity) are unstable when heated and decompose liberating carbon dioxide. As the steam condenses the carbon dioxide is redissolved and the subsequent formation of carbonic acid in the condensate return line is a major cause of corrosion.

In order to remove these undesirable features the water is initially pumped to the dealkalisation unit passing through a resin bed, where the calcium and magnesium ions are taken from the bicarbonates in the raw water and exchanged for hydrogen ions which results in production of carbonic acid.

The water leaving the unit thus contains permanent hardness, plus carbonic acid. This water passes to the degassing tower, where it is sprayed downwards through a bed of packing, counter current to a flow of air provided by a fan. The air imparts a vigorous scrubbing action on the distributed water and the carbon dioxide present is released from solution and vented to atmosphere with the exhaust air. The degassed water contains a small residual quantity of carbon dioxide which is then neutralised by an automatic *p*H correction unit, which injects into the degassed water sump a small quantity of sodium hydroxide to give a *p*H of approximately 8–9. The degassed water is then pumped through the resin bed of the base exchange softener exchanging the remaining calcium and magnesium ions it carries for sodium ions. The sodium ions possess no hardness properties and the exchange continues until the resin is exhausted. When this occurs the unit is automatically regenerated with brine.

New laundry

Eastbourne District General Hospital's new £1·25 million laundry which recently started 'production' will eventually have a total capacity of 4650 items an hour. The laundry will be providing a complete service for 17 hospitals in parts of East Sussex and Kent. It is claimed to be the most modern in Europe and will be taking over all work previously handled by four smaller district laundries.

Three types of laundry were planned: for general linen, personal wear, and foul and infected laundry. Production layouts and total wash systems were designed to process each of the three basic categories. Laundry is sorted into six different colour-coded bags at collection points in the district and transported to the reception area at the laundry, which acts as a traffic-control point.

Foul wash is immediately passed through a reserved hatch to a separate zone to avoid any risk of crosscontamination. Personal washbags are also removed from the general load, which is hooked to a hoist system and taken to the sorting room. Here the laundry is classified into mobile storage bags holding 45 kg and ultimately poured into hopper systems that link with the eight 180 kg and one 90 kg Electrolux-Wascator self-unloading, washers.

The washing machines are program-card operated for different wash cycles and will tilt to unload. Once unloaded, the laundry is transferred to 90 kg hydroextractors and then passed through self-loading and unloading tumble dryers and two flatwork ironers.

Sheets and pillowcases, an estimated quarter of all the laundry's throughput, are washed in a tunnel washer, which will handle 600–1500 kg of dry linen per hour. Because of the volume of work, the third and largest ironer was sited at the end of the tunnel-wash system to form a 'flowline'.

The foul and infected linen is washed and sterilised to DHSS thermal-disinfection requirements in 'barrier' washer extractors. The barrier machines incorporate separate doors for loading and unloading, and the machine is built into a dividing wall, so that input and output are separated. Personal laundry is washed by two Electrolux-Wascator 12 kg washers and dried by a hydroextractor.

THE INSTITUTE OF HOSPITAL ENGINEERING

Conference report – Bournemouth 1975

Glorious summer sunshine greeted delegates on the first day of the 31st annual conference of hospital engineers at Bournemouth, on the 23rd April 1975.

The Post Graduate Medical Centre at the Royal Victoria Hospital, Boscombe was the venue for the 3 day conference and was officially opened by Dr. B. G. B. Lucas, President of the IHE. Mention was made by Dr. Lucas of the need for an even greater involvement of the engineering and medical professions in a pooling of their respective expertise for the betterment of the patient, and he hoped the use of Post Graduate Medical Centres for future conferences would further this aim.

The first session of the conference, chaired by Col. Sir Joseph Weld, chairman, Wessex Regional Health Authority, started with a full house with visitors from the local fire service showing interest and joining in with helpful comment during question time. The topic was 'The application of the fire precuations act to hospital building and engineering design'. Owing to illness, C. Davies, assistant chief architect, Department of Health & Social Security, was unable to read his paper covering the building aspect of the Fire Precautions Act, and this was read by D. I. Sinclair, superintendent engineer, Department of Health & Social Security.

It was estimated that £100 million would be needed to achieve full certification. The first priority would be the long-stay psychiatric hospitals and unattended areas. Design note 2 would be rewritten and the use of retardant materials investigated as alternatives to building alterations. A common training policy would be prepared since an alert, well trained adult, was still the best alarm system.

After a buffet lunch, prepared by the hospital catering staff, the second session chaired by B. A. Hermon, regional works officer, South West Thames Regional Health Authority, was a lecture entitled 'Medical engineering maintenance—the way ahead', which was delivered by G. K. Alston, assistant regional engineer, Oxford Regional Health Authority. Great stress was placed on the increasing capital investment on medical equipment and the economic justification for a maintenance service within the National Health Service. Detailed proposals were given for the structure and recommended establishment for electronic- and medical-equipment maintenance, based at region, area and district level.

The second day started with a philosophical talk on 'Medical engineering' by Dr. S. R. Montgomery, head of mechanical engineering, University College, London, under the chairmanship of the IHE President. This lecture proved to be most thought provoking, and spoke of the interrelationships of the various functions and departments within the National Health Service and of efforts being made in providing the best health care possible, both cheaply and effectively.

The afternoon session was again chaired by Dr. Lucas, and it covered the topic 'What is technology doing to the Health Service?' The speaker, H. S. Wolff, head of bioengineering division, Clinical Research Centre, outlined the organisation of the National Research Council and the part he played therein. He went on to give some examples, illustrated with slides, of the benefits derived from the application of technology in the Health Service, from simple aids for the handicapped to sophisticated electronic equipment. Mr. Woolf also gave his views on the relationship of the hospital engineer to the selection and maintenance of technological ventures. Unfortunately, question time was too short to provide what would have been lively discussion of the challenging points raised by this speaker.

The conference dinner-dance was attended by delegates and their wives, together with invited guests. The toast, 'The Institute of Hospital Engineering', was proposed by Sir David Trench, chairman, Dorset Area Health Authority, and the response and toast to 'Our guests' by Dr. Lucas, with a response by Dame Isabel Graham Bryce, chairman, National Staff Committees for Administrative & Clerical Staff and for Nurses & Midwives. During the very pleasant evening, George Tuson was presented with the Northcroft Silver Medal Award for 1974.

On the third day, the ladies went sightseeing and shopping whilst delegates attended the Annual General Meeting, and Dr. Lucas introduced Mr. Howarth as his successor. The new President in his introductory words thanked Dr. Lucas for the efforts he had made in promoting the aims of the Institute during his term of office. The final session followed, with Mr. Howarth taking the chair for a lecture delivered by Dame Isabel Graham Bryce, entitled 'The work of the National Staff Committee in the Health Service'. Dame Isabel gave an interesting account of how and why the National Staff Committees were set up, and mentioned some of the problems that the committees had examined since their inception, including the evaluation of the Salmon Structure.

In a labour-intensive industry, staff appraisal is of the utmost importance and much work had and is being done in this particular field. The selection of staff, she went on, requires the application of acquired skills and techniques, if the outcome is to be successful.

The importance of good interviewing was a matter to which the committees had devoted considerable thought. It was Dame Isabel's conviction that a person should always leave an interview room with a feeling of satisfaction and not humiliation.

Dame Isabel concluded an interesting talk by outlining some of the more recent problems that the staff committees had been examining including the recruitment and training of specialist staff.

The conference was brought to a close at midday with the New President thanking all those who had played any part in making this a very successful conference.

The art of public speaking

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

So that he can perform his job efficiently and effectively, the professional engineer has to endure years of rigorous training. However, although he may be taught a great deal about the technical side of his subject, the other skills he needs are often ignored. The engineer, especially as his career progresses, is often called on to address an audience. He has to perform effectively without any special training.

The speaker

There is a golden rule in public speaking which should be observed on all occasions and that is 'stand up to be seen, speak up to be heard, and shut up to be appreciated'.

Public speaking is concerned with the transmission of ideas by word of mouth.

The speaker seeks to gain a reaction to his words. He is seeking to affect the individuals in his audience precisely as he wishes. This is extremely difficult to do because men are so varied. Some will come to hear a lecture with interest, others perhaps have to attend and would prefer to sleep! Some will take a critical attitude from the moment one attempts to speak. Perhaps they don't like the face, the tie, or mannerisms.

All these attitudes are found in any audience. It is the speaker's responsibility to put over his subject in such a way that the sleepers are aroused, the critics are silenced and before long they are all giving rapt attention.

One of the disadvantages of the art of public speaking is that the speaker can only perform in public, and competence only comes with practice. It is a pity that those bursting with confidence and having the 'gift of the gab' have usually not very much to say, and it is those who know what they do not know who are diffident about speaking to others. All have something to give; each one unique. No two minds think alike and we should not withhold any contribution we may be able to make.

You must remember that you will always be nervous. You must face this fact and welcome it. Do not fear it, as the day you do not fear means that you do not care, and if you do not care, neither will your audience. But you can learn to control your nervousness by the control of your breathing, your voice and, above all, your material. Each new address, or lecture, is as if it were the first. To become confident in public speaking is to become overconfident.

It is obvious that we have two problems; one is with ourselves as speakers, and the other is with the audience and the general environment.

If we are not clear about our subject, then the audience certainly isn't. If we are unable to put over our arguments in a logical way, then the audience will come to the conclusion that we are muddled thinkers. It is therefore important for the public speaker to be sure that his material is transmitted in as simple a manner as possible, for all to understand, yet he must not be childish.

In this article, I shall indicate ways in which we can prepare ourselves and our material for transmission and then talk about presentation.

Preparation

Ideas form the backbone of any subject. We begin with the idea, theme or text, and we proceed to sub-ideas and then to an eventual conclusion.

Logical order

In any subject we seek to direct minds along the narrow path of our own thoughts for 20, 30, 45 or perhaps 60 min, or even longer.

We do it by using mind pictures, the minds of our audience responding to the pictures we paint, using words.

There is a difference between spoken and written English. It is more important to be understood than to be pedantic about precise grammar. The English language has many pitfalls and if we are to worry about grammatical precision, we may become obsessed with the idea that our audience expects this precision.

Lord Cecil said 'Men talk more loosely than they write', but this does not mean that one should not strive to attain a reasonable level of grammatical correctness. However, very often in the heat of a delivery, words such as 'shall' and 'will', 'who' and 'whom', 'which' and 'when', and split infinitives, are wrongly used but these are of secondary importance and will escape the notice of all but the purist.

For those who wish to follow this line of thinking, but who have some concern for grammar, I would refer to the books *Plain Words* by Sir Ernest Gowers and Fowler's *Modern English Usage*, which will give any prospective candidate for the public platform enough information to ensure an acceptable level of grammatical usage.

It should be pointed out that a written address differs from an essay; an essay is concerned with sentences, long and short, and the modern view is to have less punctuation; also a good grammatical style is required. A written address, on the other hand, has a staccato style of short sentences and an economy of words. It is precise and to the point, avoiding verbosity.

There are various ways of achieving a personal style. I use a method I have developed over a number

Mr. Tuson is with the Wessex Regional Health Authority, *Highcroft, Romsey Road, Winchester S022 5DH*

This article is based on lectures given by the author at the Keele Courses for Hospital Engineering

of years. It is simple and will at least, I hope, help those who have had no previous experience of public speaking.

The problem in speech making is the placing of each idea in its logical sequence. To develop the idea, we use the human frame—the skull, the vertebrae and the tail (Fig. 7A). This is based on a rule of three referred to later. The skull we may call the theme, the main concept. The vertebrae are the various ideas concerned with the theme, and the tail is the conclusion.

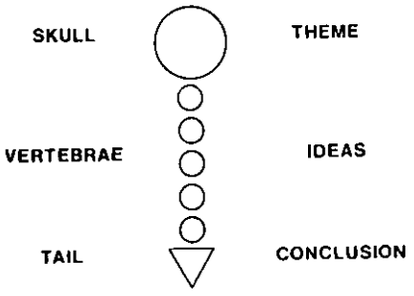


Fig. 1A

To this we add the ribs, which are the facts related to the ideas (Fig. 1B). You will note that the ribs are on the left- and right-hand side of the vertebrae, and we may say that these represent the facts for and the facts against an idea.

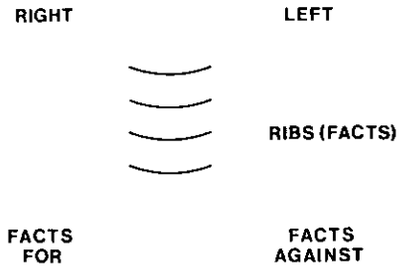


Fig. 1B

One of the major problems in public speaking is to give a balanced view. Very often we hear the speaker who gives a completely one-sided view of a situation as if it were the only truth. If he is in a pulpit, he is safe because he is two-metres above criticism! But, if he has an audience of engineers he will, without doubt, be questioned, and his sins of omission will see the light of day. It is therefore important to ensure that we respect our audience by giving them a balanced view.

One of the great problems of the communication media is that so often we only hear one side of a story. This is particularly apparent on the political scene, where a politician will appear on television one night to tell us one side of truth and the following night another politician will give us the other side of truth. Sometimes we are left wondering what is the truth! Perhaps if public speakers had been trained to respect their audience more, we might get a more balanced view of truth.

A further problem of the public speaker is to determine how much information his audience can take or how much information he can impart without causing confusion.

The rule of three

Over a good number of years of public speaking, I personally have become convinced that levels of retention of speakers and audience are limited and they are limited to what I define as a 'rule of three' (Fig. 2).

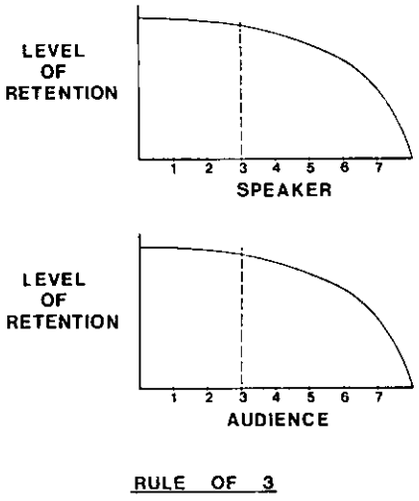


Fig. 2

You may check this by thinking of a shopping list of varied items. How many can we readily remember without using a check list? I would suggest that we can easily remember three, but after this our level of retention falls. Similarly, a speaker who speaks without notes, unless he has very carefully rehearsed or is an accomplished speaker, has difficulty in putting over more than three major points. To include a fourth very often leads to confusion or places a great strain on the memory. This is equally true with an audience.

The chart of relative effectiveness of learning (Fig. 3) indicates that only 20% of the subject matter will be absorbed, so it is important to ensure that the number of major points is limited to attain maximum effectiveness.

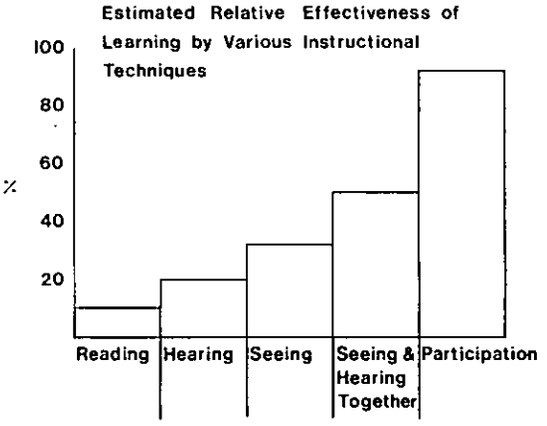


Fig. 3

A second rule of three

We are all aware that in teaching, it is ideal to stress ideas three times, very often in different ways, to put over a point.

There is the classic story told by preachers of the old farmer whose sermons apparently were remembered by congregations when the more mature preachers had been forgotten. When questioned on his methods that lead to his success he simply said 'I tell them what I am going to tell them, then I tell them, and then I tell them what I have told them'.

A third rule of three

Let me now develop this theme:

(*a*) The skull is our theme.

(*b*) The vertebrae are our ideas.

(*c*) The tail is the conclusion.

The centre (*b*) is usually the main part of the speech. Another way of stating this is (Fig. 4):

(*a*) introduction

(*b*) explanation

(*c*) conclusion

In a technical or scientific speech:

(*a*) definition

(*b*) exposition

(*c*) conclusion.

You will note that there is always a conclusion. Without a conclusion we are, as with many of the plays we see on television, left to guess. Begin with a good introduction, follow with a well thought out exposition and end with a good conclusion (even if the conclusion is that we cannot yet come to a definite conclusion).

Three threes

Consider a subject with which most readers will be familiar:

My problems as an assistant engineer

Introduction

Exposition

1	Technical	a range b engineering c building
2	Managerial	a organisation b directing c controlling
3	Personal	a senior officer b subordinates c myself

Conclusion

We have an introduction; we have an exposition and a conclusion. The exposition is the important part. Divide this into three: you may decide to talk about the past, the present and the future, which is an excellent way of dealing with many subjects, and an easy one.

Here I have developed three elements:

(*a*) technical

(*b*) managerial

(*c*) personal.

You may decide on alliteration, say using past, present and prophecy.

This is a great help to an audience in remembering your speech, but you will note that these sections break down into three more.

If you are asked to speak for ten minutes on your problems as an assistant engineer, you will note that we have given 11 elements: introduction, three points on technical matters, three on managerial and three on personal, plus a conclusion, so we have less than one minute for each element. I suggest that most people would find it easy to speak on each element for less than one minute.

You are now writing your lecture almost automatically. It has become easy to do. This is a simple method. If it is simple to you as a speaker, it will be reasonably simple to your audience. If it is complicated to you as a speaker, to your audience it is doubly complicated.

It is important in selecting any speech to have a precise title that can be understood. Many speeches are given with the view to answering a question or a series of questions. Herein lies a danger! It is more important clearly to identify the question than to provide an answer. We know this from experience in taking examinations, that, unless we identify the question precisely, we will not get the right answer. If you are asked to speak on a subject, it is important that you address yourself to that subject. Beware of digression—this is a major trap to all public speakers.

We must discover the elements in the question, arrange these in some form or chronological order and build up a structure or 'skeleton' which may be done by the method previously described. Having decided the subject of the question; having built up the structure, the final step is to ensure that the conclusion answers the question precisely, and rounds off the subject leaving the audience with a clear concept of the argument or subject.

There is a great tendency for speakers to become obsessed with certain points they wish to put over. Having put over their 'punch' lines, they then drift on towards a nebulous conclusion. It is better if the conclusion is the 'punch' line.

Preparing a text

It is not easy to get inside the mind of your audience, as each audience is unique. You may have a large range from infant to octogenarian and people from all walks of life, for instance as in a Church. On the other hand you may have to speak to graduates in nuclear physics. The approach will be different. The content will be different.

With a general audience it is important not to be too academic, but to talk in general terms, to give simple but effective illustrations. It is, at the same time, possible to speak simply and yet to be profound.

It might be said that the greatest example of this is found in the teaching of Christ who spoke about everyday things. Yet for 2000 years learned theo-

logians have pondered his apparently simple statements which were so profound. The parables appeal to the 'intelligence through the imagination'. One can hardly hope to rise to these heights, but yet there may be a flash of inspiration on the odd occasion.

On the other hand, there is the highly technical lecture which requires a wide range of knowledge of the subject, which is, no doubt, shared by the members of your audience, and therefore you begin with a handicap.

Your ability to add to their knowledge will be limited and it is interesting to note that papers are usually written either to stress managerial functions, new elements in research or new ideas. This places the speaker in a very stringent situation and one must weigh carefully any invitation to speak on such subjects.

I was interested to note some time ago that Enoch Powell declined an invitation to speak at a certain function because he said he had nothing to say on the subject proposed. It is far better to decline an invitation on a subject with which you are not well versed than to accept and to expose yourself to severe criticism. Better be silent and be thought foolish than to speak and remove all doubt!

It is important to find out about a prospective audience: type, sex, number expected, intellectual levels etc. Don't be afraid to ask questions, as failure to ask relevant questions may lead, on some occasions, to an embarrassing situation. I was once asked to speak to an anticipated audience of about 100—it was termed a 'family audience'. On arrival at the hall, I found myself confronted with 100 or more children. After that kind of experience, one appreciates the importance of asking pointed questions.

How long should one be expected to speak? Here we are concerned with the pattern of performance during a lecture without a break. Fig. 6 indicates the level of performance that can be expected in the teaching lecture situation. I would, however, suggest that this is not necessarily the case in the general lecture which can contain various digressions.

There are some speakers who can speak for an hour and at the end of it the audience would still prefer more. With others, after five minutes one has had enough.

Prepare for an exact time within your ability. If you don't recognise your ability, your audience will. You can easily tell when the audience have had enough. They become restless; they are conscious that the seats are hard and that the subject is dull.

Visual aids are a help, but are not always the answer, as, if these are not well presented, the audience quickly lose interest. How many times have you attended meetings where the speaker has gone through 50 slides making comments on each. After the first 20, no matter how good the slides are, you have had enough.

The importance of a good beginning

The opening of any address is important, but it is the technique of opening that is vital. With some audiences it is possible to begin with a joke to set them at their ease, but when speaking to learned bodies one must be sure that the joke is appropriate, because the joke that fails has the very reverse effect of that anticipated and is something from which it is hard to recover.

An opening joke is very dangerous to small audiences or unfamiliar audiences. It is far better to rely on your own good humour and presence than to rely on making your audience relax by the use of jokes.

The opening words of any address should be carefully chosen to attract immediate interest. This requires clarity of speech in the form of a concise statement to acquaint the audience in general terms with the speech. Very often one may use a quotation, a personal experience or an observation. Certainly at this stage of an address, any rambling whatsoever will destroy some element of interest of the audience and will require great effort later to regain their attention.

Extempore or read

There is a great controversy amongst public speakers as to whether one should write one's speech or rely on extempore delivery. From observation, I would suggest that there is a place for both.

To speak extemporarily on any subject requires one to have a very wide knowledge of the subject, to have been well trained in it and to have a logical appreciation of all its ingredients and facets.

For those starting out on the treadmill of public speaking, perhaps the quotation from Francis Bacon

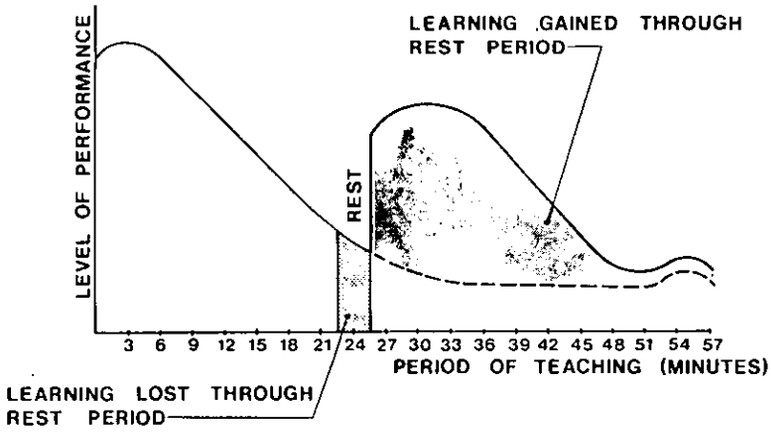


Fig. 4

is worthy of note:

> 'Reading maketh a full man, speaking a ready man, and writing an exact man'

A speaker needs to be all of these.

There are some who tell you not to write out your speech but to get a few headings and speak to the headings. This is all very well for speeches with which you are thoroughly familiar, but the majority of speeches are not like this. They demand a great deal of thought. By writing out your speech you make your thoughts precise and avoid that vagueness that mars so many speeches.

The structural method I have outlined will at least ensure that your structure is on a logical base. The problem is filling it with the correct use of words which flow from one idea to another, slowly but surely bringing it to an obvious conclusion.

When writing out a paper one has to decide such aspects as what subject matter to deal with, which words to use, which ideas to emphasise, what should be omitted. It is very difficult to become ruthless with omission, to decide to leave out a certain section.

The writing process is arduous and tiring, but is creative. Sheridan said 'Only after having written is satisfaction achieved'. But the converse is also true—easy reading is difficult to write.

My own method is to use the structural system that I have outlined. Having done this, I then dictate to my secretary, say possibly for an hour, filling in all the detail. This is typed double-spaced and I then go through what I have written correcting it and re-drafting it. It is then double-spaced typed again and generally the job is done. Double-spaced clear paragraphs are essential for easy reading. I then count the number of words and work out the exact time it will take to deliver a particular address. I have found a written text invaluable at question times in confirming what one actually said.

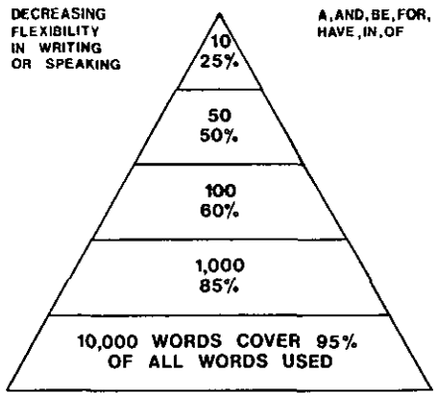
I always use loose leaf binders for my addresses as I have seen so many problems arise with cards which become mixed or dropped. Also the full text is available at a moment's notice if as sometimes happens one is asked to fill in for a speaker who has had to withdraw at the last minute.

Relationships of preparation and delivery

It is important to determine the time allowed and prepare to meet this precisely. This will require a timed trial before the event. I usually find it necessary to try a speech twice, on the first occasion to pronounce words and check delivery to ensure clear thought and ease of expression; the second time one is able to determine the exact time for delivery. This demands an arduous, precise preparation.

The golden rule is to write simply. By dictating I find that one uses simple words. The words have flow because, in dictating, we are using words with a flowing conversational style. One also gains by using this method in learning the discipline of economy. One avoids the trap of blinding the audience with science. One seeks to use the shortest words possible in the shortest sentences compatible with a smooth flow, getting as close to conversational speech in writing as one can. By this method one quickly achieves a readable style and avoids repetition and woolly padding.

In the word pyramid shown in Fig. 5 it is interesting to note that 900 to 1000 words would cover about 85% of the requirements of all ordinary subjects.



THE ENGLISH WORD PYRAMID 'A'

Fig. 5

There are words that are relevant to a particular profession, such as words used in medicine, in architecture and engineering. One should be careful in the use of these words and ensure that if they are to be used, then to a lay audience some explanation should be given.

Perhaps one of the problems that engineers have to face is that the mathematical content of their training far outweighs the literary content. I have noted from many Keele Courses that only perhaps one or two per cent of engineers are members of public libraries and read good literary works. It is important that, to increase one's fluency, one should read good literature and a good newspaper. There are many books that one may read to one's benefit.

For those of us who work in the Government Service, *Plain Words* by Sir Ernest Gowers is perhaps the best known, but it is surprising how few engineers have heard of this book.

A comparison between Lloyd George and Churchill is interesting. Churchill wrote his speeches in full. His method was to dictate a speech, then to redraft until he was satisfied that it was exact in every sense. He would then spend considerable time in practising its delivery. It may be said of him that he was a reader of speeches. Lloyd George on the other hand, was an extempore speaker who would use a few notes and rely on his ability to put over his ideas. It has been said of him that his speeches were short and it is generally true that the use of headings does tend to shorten deliveries (a weakness appreciated by many). It may also be fair to say that extempore speakers rely heavily on their personalities and general presence.

It is helpful to have training in elocution, but not altogether necessary. Certainly, if we attend a poetry reading, then elocution is of great benefit, but public speaking involves more than appropriate words, it involves the whole man, the personality and all that goes with it.

The hazards of public speaking

Writing takes time and, while no speaker will begrudge time or effort to give of his best, there may be times when you will have no time to write out the whole of your speech, but you will be well advised to write as much as you can, and especially those vital parts that you wish to bring out.

After all this preparation, having got your speech, having written it out, you cannot guarantee success. If there is such a thing as success!

You may deliver the same speech on two different occasions. At one it will be well received, at another, the audience gives no indication. You may think it is the most wonderful piece of work you have done, but to them, it can be the reverse.

Public speaking has a strong effect on the emotions. One can be so easily elated or depressed. How often will a colleague, after delivering a speech, come and ask your opinion, very often in a roundabout way. You know that he wants you to tell him that he did very well and it is very difficult to tell him the truth. As time goes by you will learn to adopt a more professional approach. You will learn to put over your material as well as you can and leave it at that.

Presentation

Although one may have prepared a good speech, this can be completely ruined in the presentation. Many people when they speak for the first time in public find it an unnerving experience. They are confronted with a sea of faces and dry up! The voice develops a tremor, becomes faint and in the audience one sees some learned person who has a wry look on his face, making one feel even worse. Or perhaps during one's address, when making a point, someone shakes his head in dissent and the debacle is complete.

Somehow one stumbles through the material, increasing in speed until the end is reached. With a sigh one sits down confused and very depressed.

Perhaps you have had some advice on how to prepare your material. You may have used cards with headings. This has meant that you have had to rely on your ability to make up sentences as you went along through your speech. At some point the mind froze and what came out was not very clear, crisp or logical. It is therefore important to understand one or two basic rules about presentation.

The first rule is to have all your material in front of you written down word perfect. Once a speech has been written down in full there is a certain technique which I have adopted and have found extremely useful. This is a technique which one uses in singing, and after all, there is little difference between singing and speaking, in fact, training for singing is better than having elocution lessons.

Those of you who have been Anglican choirboys will immediately recognise the method shown in Fig. 8 as being included in the Anglican Psalter.

Too often words are treated as if they were *unimportant passengers* riding a musical bus which had to reach its garage on time and intact.

Having written out the speech, break up the sentences into a series of words by marking between them. This ensures short sentences and introduces a certain sense of 'punch' into the delivery. Together with this, the underlining of important words or 'punch' words, means that the delivery is releated to short sections with 'punch' words. I have found that underlining in red ink makes the words stand out clearly in a script.

The 'punch' words are those that we wish to emphasise in a sentence above the other words. This is done by raising the voice, putting more power into the word or slowly pronouncing the word.

This method gives a rolling effect to the delivery like waves on the seashore. Some large, some small, some crashing, some soft, which makes the delivery interesting and more acceptable than the flat cadence of words strung in long sentences which are difficult to follow. Eventually a flat cadence becomes boring, resulting in the usual response of an audience that has 'switched off'.

The system indicated is basically related to our breathing, natural pace and voice. We are all different in this respect, in the sound of the voice, the bass, contralto, tenor, soprano effect. The speed of the voice has been with us for many years and we are automatically recognised on the telephone by these characteristics.

This is a point at which some kind of voice training is useful, either in singing or in elocution.

Some are able to retain breath longer than others; some able to say more words per breath, some less. To use this system, the first step is to try out a sentence, to put in marks that give one an easy delivery and place emphasis on the 'punch' words. Eventually you will find that you are obtaining a rhythm.

Delivery

Having prepared the material, one is now ready to deliver. To have your material in front of you, word for word ready for delivery, means that it is one problem that you can forget. You no longer have to think about what to say. The problem is how to say it!

To be concerned about what to say and how to deliver at the same time may lead to difficulties. Having the material written down means that you won't ramble. Two elements that are of importance are pronunciation and enunciation. There is a tendency with many to drop the voice at the end of a line. How often have you heard a speaker where the first half of a sentence is heard, but the second half is lost, the voice having been dropped below the general sound level of the auditorium.

No singer would consider giving a recital without long practice beforehand to ensure that the voice is free with the necessary power behind it and control over it. This is also true to some extent in public speaking; to gain clarity and power it is important to practise the voice beforehand.

Many people make the mistake of speaking in the normal conversational way. This is inadequate in public speaking unless one has a microphone and voice amplification. Even with these there is a tendency to become boring as the rise and fall and 'punch' are missing. There are a number of elocution exercises which should be carried out before speaking to make

the mouth supple and the voice clear. These exercises should not be carried out harshly to stretch the mouth and throat, but gently and perhaps a dozen times on each exercise to give the voice the necessary suppleness.

One should open the mouth as wide as possible and then seek to open the back of the throat, opening and closing the mouth possibly about a dozen times. Another is to place the tongue in the cheek to the full extent, and press the cheek going around the mouth in a complete circle. This has the effect of slightly stretching the muscles in the cheeks. Another exercise is to put the tongue out to its maximum extent and retract about a dozen times. Another is to blow the cheeks out alternately. Further to this, the nose should be cleared, and gargling a few minutes before the speech also helps.

Speakers should avoid eating chocolate or drinking milk before a delivery because this tends to 'clog' the voice. Lemon drops or throat-clearing lozenges are very useful.

You may be performing in a building or in the open air. There is a world of difference speaking in an enclosed space compared with speaking in the open air and the techniques are quite different.

I am always amused at election time to observe politicians on television speaking at open-air meetings. After about four days they are reduced to croaking, simply because they have had no training in the open-air technique. This requires the throwing of the voice from the diaphragm to the mouth with clear enunciation and with power to match it. The projection of the voice depends on the power behind it and the breath control over it. The difference in level between open-air speech and that in a small room is extreme. The breath control must be precise in each situation.

It is important to maintain the head and the body in an upright position so that the sound passes through the diaphragm on to the larynx. This may be demonstrated by sounding a note with the head in a vertical position and slowly lowering the head. The problem for politicians speaking in the open air is that of power. This may only be gained with practice as in singing. If one hasn't used the voice with power for some time, then it is difficult to exercise breath control, so it is important to carry out a few exercises before speaking in order to ensure that the body at least is ready to deliver and is not under undue pressure.

It is important to try out the voice in any hall prior to delivery. I know of no worse experience than to go into an unknown auditorium and be asked to speak without having tried out the voice.

Those who have had voice tuition at Keele University will know the tremendous difference required in using the voice in the University Chapel and the Walter Moberley Hall, and have been surprised at the power required to make the voice clearly heard in both situations. The acoustic properties of both are different. The University Chapel is almost unnerving as it takes quite some considerable time to pitch the voice correctly to be heard at all points without giving an impression of strain, and to give a pleasing effect.

As already pointed out, the most common failure in public speakers is to drop the voice at the end of a sentence. To overcome this, one should overaccentuate the last word in a sentence. Again, course members at Keele have been surprised how one can overaccentuate a word in public speaking which to the audience sounds perfectly normal, yet to do this in ordinary conversation would make conversation sound rather odd. There is a difference if the hall is filled or partially filled, but having tried out the voice in an empty hall, one has a general level at which to aim. It is then important at the beginning of a speech to modulate slightly to get the level right for the building and audience.

To try out the voice in a hall before a meeting, the method I use is to walk around the building from corner to corner, first whistling, which gives one a good idea of the size of the hall, then using the voice reading certain words at different power levels. It is useful to get a friend to help who will give you a good idea of the level you have attained and its clarity.

Later, when you are speaking to your audience, the head should be turned only across the two opposite corners, as to throw the voice on to side walls reduces distinction to parts of an auditorium. The essence of good speaking is to have variation, to alter pace on occasions under the excitement of a moment; to go fast on another occasion, and under the solemnity of another occasion to go slowly; in one place to speak lightly, in others to speak sharply.

The rate of speech is determined by the size of the hall. In a small building the rate of speech can be faster than in a large building. In a very large building, it is important to speak very slowly to allow the voice to penetrate every corner of the building, otherwise one word will appear to catch up with another to members of the audience at the far end of the building. However, it has been said that people learn more with a high rate of speech than with a low rate of speech. This is debatable, but if one uses the fast and slow techniques in speaking, then this is possibly the best compromise. The appearance that one is reading the speech can be overcome by body movement, by moving backwards and forwards slowly from the reading desk, but turning the head across the two corners of the room scanning the audience, and at the same time scanning the script.

To do this, I find it essential to have the script typed double-spaced. It must also be in a favourable position for one's stature and one should have, if possible, a lectern or reading desk which is a suitable height. The best distance away from the reading desk is easily measured by the length of one's arms, which, if held in the straight position, means that one is approximately at a maximum of 1 m away from the reading desk.

Speakers' idiosyncrasies find a ready response with the humorous. Avoid thrusting hands deep into pockets or poking the ears. It is very convenient, particularly for the nervous, to grip the reading desk using a side-to-side motion firstly with the left hand and then with the right. This ensures that the hands are not becoming obtrusive.

When Billy Graham first preached, he was nicknamed the 'windmill' as his arms made circles in front of his face! Be careful that you don't pick up a name for your idiosyncrasy! I remember a speaker who used the word 'again' so much that he was nicknamed 'Mr Again'.

One of the problems of which some people are very

aware is that of accent. One must remember that very often a speech is enhanced by an accent, so use your accent to effect and don't be ashamed of it.

The crude joke or rudeness to the audience may be the end of you as a speaker. You may cause offence to certain people who will never forget or forgive. The cutting comment made to one speaker is worthy of note: 'I cannot hear what you say for seeing what you are'.

Conclusion

As one gains more experience and confidence in public speaking, the use of a full written text will be replaced by comprehensive notes, and eventually by headings or no notes at all.

The alternative is to begin without notes at all, to speak extempore on all occasions. My observations over the years are that such beginnings seldom develop the best style, which has precision, good choice of words and flowing delivery.

Development as a public speaker is only attained by practice. It is unfortunate for many that opportunities for practice are limited and thus development is slow.

To achieve any success in public speaking requires continuous 'freshness'. The stale speaker reiterating his pet theories is soon discarded. The speaker with new ideas, concepts, controversy, a progressive and optimistic outlook will always attract. However, it should be pointed out that many public speakers, particularly politicians, exaggerate or heighten controversy to gain an audience. They are then in a position of making friends—and enemies. The public speaker who has no ideas, no message, no controversy has nothing else, except perhaps a few jokes and will soon fade. It is not easy to declare 'truths' that are unpalatable to others and to continue to maintain one's position without wavering. An optimistic and progressive outlook is essential as it is a message of hope for the future which will attract others to our position whether politically, economically, financially, technically or otherwise.

The preachers of doom and gloom seldom attract and are often objects of ridicule. An audience needs to be stimulated, challenged, exhorted and moved to new levels of participation and interest. This is a delicate operation requiring an ability to understand people and their motivation.

Much depends on our personal attitude to people. Audiences very quickly make their own assessment of a speaker's attitude towards them. Unless a speaker has the ability to make himself personally acceptable to his audience, he has failed.

It has been well said that the evaluation of one's abilities are best recognised by others. One may feel very inadequate on some occasions, but those who invite a speaker have usually carefully considered the advisability of the choice and the ability of that person to perform.

It is wise to weigh carefully the rejection of an invitation. If you have something to say on the subject proposed, then it will be prudent to accept as it will be a further opportunity to practise the art and to gain confidence.

Finally, for any lengthy speech ensure that a glass of water is provided. This is useful in that there are occasions when perhaps you have lost your way in an address. Stop and take a drink, this gives a speaker the opportunity of collecting his thoughts. It also gives the audience an opportunity to relax. In a lengthy speech it is necessary to break tension at least every 10 min by an anecdote, humour or diversion, otherwise the audience will tire.

For those who are nervous, the taking of six good deep breaths will usually get rid of this and give one more poise for the occasion.

This is a subject where there is no perfection; where failure level is high and cannot be hidden; where a word spoken is difficult to retract. One's beliefs, personality, and abilities are thrown to the public gaze and they are the adjudicators!

Scottish Branches Conference

The 10th Biannual Conference of the Joint Scottish Branches is being held this year in Glasgow from the 23rd to 25th October 1975.

The Executive Group of the South Western District of the Greater Glasgow Health Board is making accommodation available at the Walton Conference Centre, which is situated in the grounds of the Southern General Hospital.

At the time of going to press, details of the content of the programme have yet to be finalised. However, a very interesting programme is being planned and the objective will be to promote new techniques in both engineering and management skills which it is hoped will benefit health service engineering as a whole.

The President, F. Hugh Howorth is to attend and it is hoped that the conference will be well supported.

Further information and forms of registration may be obtained from: T. M. Sinclair, Hon. Branch Secretary, West of Scotland Branch, 3 Morven Way, Kirkintilloch G66 3QL, Scotland.

OCTOBER SEMINAR

Telecommunications in hospitals

The Institute is to hold a 1-day seminar on 'Telecommunications in hospitals' on the 15th October 1975 at the Institution of Mechanical Engineers, Birdcage Walk, London. Speakers will include Prof. K. B. Hayley of the University of Birmingham, representatives from manufacturers, a chief nursing officer and a member of the staff of the DHSS Operations & Management Department. Further details will be given in the next issue of *Hospital Engineering*.

Tickets will cost £6, which will include morning coffee, lunch and afternoon tea. Applications should be made to: The Secretary, Institute of Hospital Engineering, 20 Landport Terrace, Southsea, Hants. PO1 2RG.

Classified Advertisements

OFFICIAL APPOINTMENTS
SITUATIONS VACANT
COURSES, EQUIPMENT ETC.

To place an advertisement in this section, please write or telephone:
Classified Advertisement Department, *HOSPITAL ENGINEERING*
Peter Peregrinus Ltd.
Station House, Nightingale Road,
Hitchin, Herts. SG5 1RJ, England
Telephone: Hitchin (s.t.d. 0462) 53331, ext. 276

APPOINTMENTS AND SITUATIONS VACANT

SALOP AREA HEALTH AUTHORITY

HOSPITAL ENGINEER

SHROPSHIRE

We need a good engineer who will take charge of a Sub-Group of small hospitals and who himself will be based at the main Wrekin Hospital, Wellington.

The post is graded at less than 24 points and a salary award is pending.

Most of the hospitals are based in lovely countryside but in an area whose Health Services are expanding due to new town development.

This is a challenging post and applications are invited from suitably qualified officers from the merged health services.

Please write for job description and an application form to:

Personnel Dept.,
Salop Area Health Authority,
The Limes,
Belle Vue Road,
Shrewsbury

Additional enquiries should be addressed to Mr. R. Edwards, Area Engineer, (Tel.: Shrewsbury 52244).

Closing date for return of applications—**25th July 1975**

Applications are invited for the post of:

HOSPITAL ENGINEER

at Moorgate General Hospital and Badsley Lane Hospital.

The successful applicant will be responsible to the Area Engineer for the day to day management of Work Services.

In addition, to having served a recognised apprenticeship, applicant must have a sound knowledge of maintenance and installation of mechanical and electrical services.

Qualifications Required

(i) H.N.C. Electrical or Electronic Engineering
(ii) H.N.C. Mechanical Engineering
(iii) C. & G. Technicians Certificates (No. 293, 255, 57 or 281) with relevant endorsements.

Salary Scale

The national salary scale for Hospital Engineers is under review and is expected to be on the scale of:

£3351—£3942+Responsibility Allowance of £108 p.a.

Application forms, job description or further details may be obtained from: Area Personnel Officer, Rotherham Area Health Authority, Oakwood Hall Hospital, Rotherham S60 2UN.

Closing date for applications 25th July, 1975.

ROTHERHAM Area Health Authority

LIVERPOOL AREA HEALTH AUTHORITY (Teaching)

APPOINTMENT OF

AREA ENGINEER

SALARY SCALE: £6816—£8211 per annum
(subject to confirmation)

Applications are invited from suitably qualified persons who have sound knowledge of engineering maintenance design and construction, preferably in a large undertaking and a good working knowledge of engineering techniques and standards.

This is a Teaching Area comprising 23 hospitals and associated Health Centres and Clinics; a new Teaching Hospital is in the course of construction.

Application forms and job descriptions can be obtained from the Area Personnel Officer, Orleans House, Edmund Street, Liverpool, L3 9NG (Telephone 051 227 4011, Extension 14 or 12).

Closing date for receipt of applications: 21st July 1975.

HE14810

DORSET AREA HEALTH AUTHORITY

EAST DORSET HEALTH CARE DISTRICT

ASSISTANT ENGINEER

required for managerial duties associated with the installation, operation and maintenance of engineering services in Health Service premises. Duties will include the implementation of planned maintenance schemes for the general services, together with the maintenance of special hospital equipment.

Applicants must have a recognised craft apprenticeship, be qualified at least to O.N.C. engineering and preferably be studying for a higher qualification.

Salary scale—£2270 rising to £2600 p.a. plus threshold agreement.

A job description and application form can be obtained from the Employment Officer, District Management Team Offices, Royal Victoria Hospital, Shelley Road, Boscombe, Bournemouth, Dorset. BH1 4HX.

APPOINTMENTS AND SITUATIONS VACANT

SOUTH DISTRICT

ASSISTANT ENGINEER

Post offers excellent opportunities for candidates to gain experience in various hospitals in the District. Day release for further studies is normally granted. Applicants must have completed an apprenticeship in mechanical or electrical engineering or otherwise acquired thorough practical training appropriate to duties and responsibilities of post. Experience in plant operation and maintenance an advantage. O.N.C. in Engineering or equivalent approved qualifications necessary. Salary £2271—£2601 plus threshold payment of £229 p.a. Increase pending.

Application forms and job description available from **District Administrator, 50 Holly Walk, Leamington Spa**, to be returned within 10 days of the appearance of this advertisement.

WARWICKSHIRE
Area Health Authority

DUDLEY AREA HEALTH AUTHORITY

Area Engineer

£5040 – £6060
(pending pay award)

This key position at the head of our Area Engineering function requires a senior engineer with considerable knowledge of the services engineering requirements of hospitals.

Reporting directly to the Area Works Officer, the successful applicant will be responsible for planning and implementing all maintenance requirements, monitoring the operation of all engineering plant and services to ensure conformity with safety standards, and co-ordinating design and construction work for all capital engineering schemes in the Area.

A wide knowledge of services engineering is essential and previous experience within the hospital service would be an advantage. Applicants will be expected to hold appropriate qualifications.

Full details and application forms, returnable by 28th July 1975, are available from:—

The Area Personnel Officer, Dudley Area Health Authority, Kelvin House, 6 The Broadway, Dudley, West Midlands DY1 4PX. Telephone: Dudley 56911 Ext. 218.

TENDERS

SOUTH GLAMORGAN AREA HEALTH AUTHORITY

Applications are invited from Contractors with registered offices within the area of South East Wales for inclusion on the South Glamorgan Health Authority's List of Approved Contractors.

1. General Contractors
2. Electrical Engineering Contractors
3. Mechanical Engineering Contractors
4. Structural Engineering Contractors

Applicants are requested to state the value of contract work that they would be prepared to undertake:—

£150 000—£5000, £5000—£1000, £1000 and under

Those Contractors who are known to be already included on the Authority's List need not apply.

Application forms can be obtained from Mr. C. K. Davies, Area Planning Officer, South Glamorgan Health Authority, University Hospital of Wales, Heath, Cardiff.

The closing date for receipt of completed application forms is the 31st July 1975.

MISCELLANEOUS

CIRCULATING PUMPS and Steam Turbines, Complete units, electric and steam, spares and service. TURNEY TURBINES Ltd., 67 Station Road, Harrow. Tel: 01–427 1355 and 01–427 3449

Classified advertisements for the next issue of
HOSPITAL ENGINEERING
published 5th September, should be received not later than Friday, 22nd August.

Index to Advertisers

Please mention 'Hospital Engineering' when replying to advertisers

Printed in England by C. F. Hodgson & Son Limited, 50 Holloway Road, London N7 8JL

When you're looking for support let nothing stand in your way

Medirail

BOC is here for life

The only equipment support system worthy of the name is one that can be planned as a standardized facility throughout the hospital. Always at the same heights. Always in the right place. Always demanding the same simple operating routine. No matter what stands in its way.

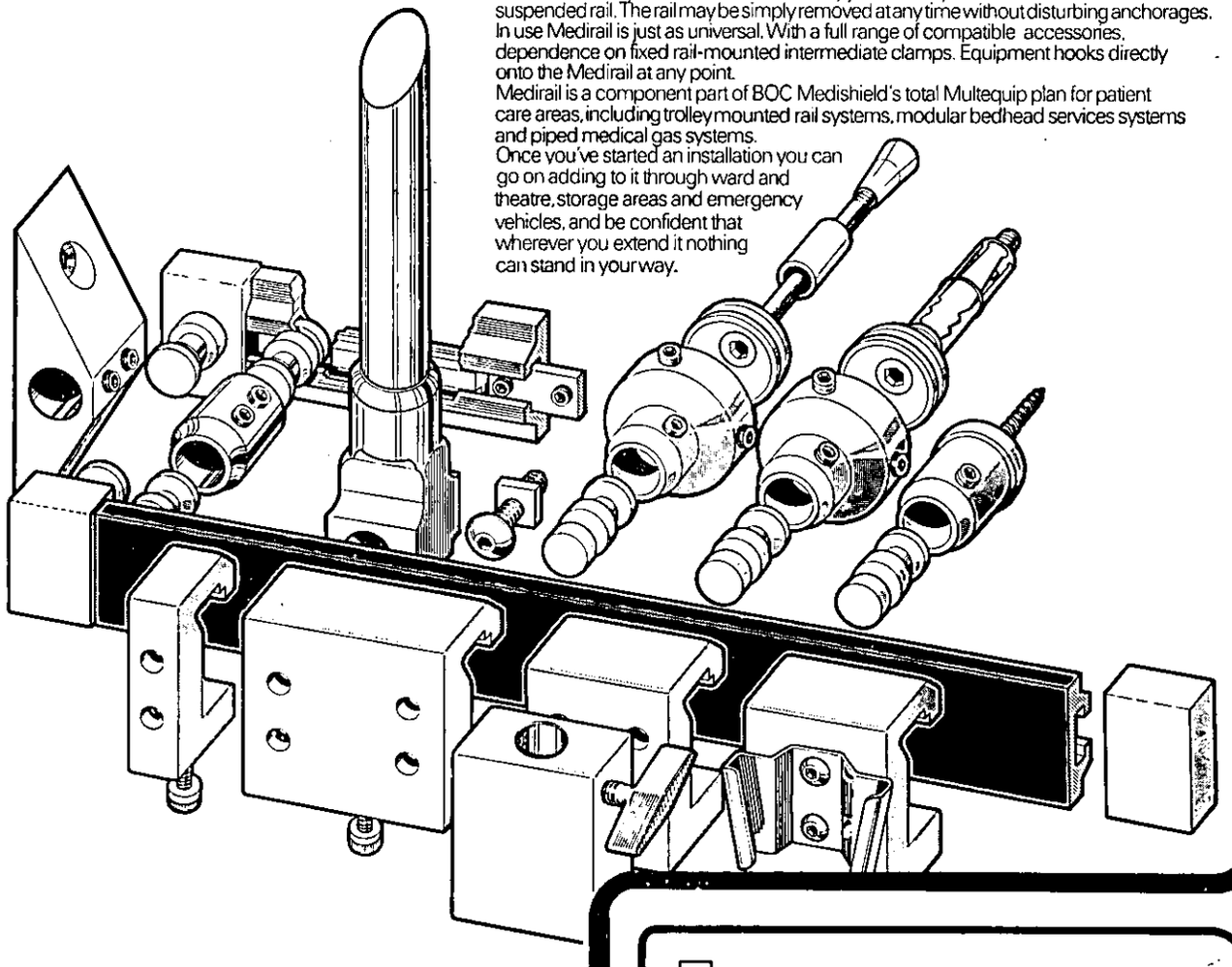
Unfortunately with most support rails you find yourself up against a brick wall. No solid wall in the right place, and the continuity of the whole system comes unstuck.

Medirail is the first universal support system that shuns the backs-to-the-wall attitude. With its simple and adaptable mounting kits designed for in-house installation, Medirail takes partitions, window recesses, hollow walls, even ambulance bodywork in its stride and may just as easily be installed overhead as a suspended rail. The rail may be simply removed at any time without disturbing anchorages.

In use Medirail is just as universal. With a full range of compatible accessories, dependence on fixed rail-mounted intermediate clamps. Equipment hooks directly onto the Medirail at any point.

Medirail is a component part of BOC Medishield's total Multequip plan for patient care areas, including trolley mounted rail systems, modular bedhead services systems and piped medical gas systems.

Once you've started an installation you can go on adding to it through ward and theatre, storage areas and emergency vehicles, and be confident that wherever you extend it nothing can stand in your way.



BOC Medishield

BOC Medishield
Elizabeth Way Harlow
Essex CM19 5AB England
Telephone Harlow (0279) 29692
Cables Britoxygen Harlow
Telex 81479

☐ Please send me details of the Medirail System

Name _____

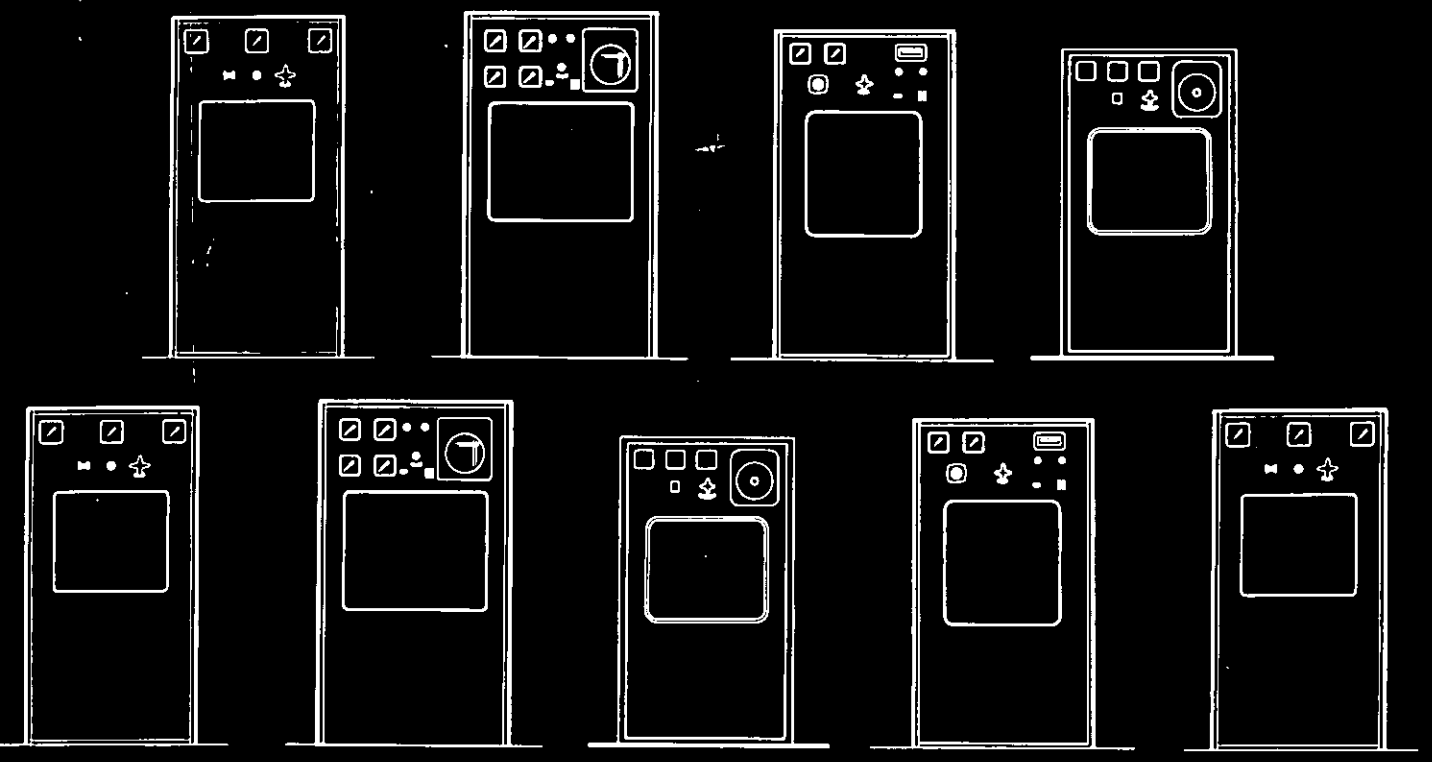
Position _____

Hospital _____

Address _____

HE _____

THACKRAY



All autoclaves look very much the same but...

The latest range of Thackray automatic high speed autoclaves including Porous Load, Downward Displacement, Rapid Cooling Fluids and Laboratory Units incorporate many unique features and user benefits.

All models incorporate the Autoclam® steam sealed sliding door which can only be opened when the chamber is at atmospheric pressure. This is an inherant safety feature which eliminates the necessity for complex pressure locking devices and thus reduces maintenance requirements.

The Porous Load autoclave incorporates a highly efficient air removal stage, with a unique partial pressure air detection system. This system will automatically cancel the cycle and interlock the door controls should residual air produce adverse sterilizing conditions.

Thackray autoclaves, all of which conform to BS 3970 and HTM 10, are available in a range of standard chamber sizes. These are designed to take full 10, 15, 21 and 28 cu. ft. loads even taking into account the space usually lost due to loading arrangements.

In order to ensure that your Thackray autoclave will always give you the best results, we operate an after sales service that is second to none. This includes standard service calls, planned preventive maintenance contracts, and a 24 hour emergency service which operates 365 days a year.

For further information, please contact:
Chas. F. Thackray Limited. Head Office: P.O. Box 171, Park Street, Leeds LS1 1RQ. England.

®Autoclam is a registered trade mark of Chas. F. Thackray Limited