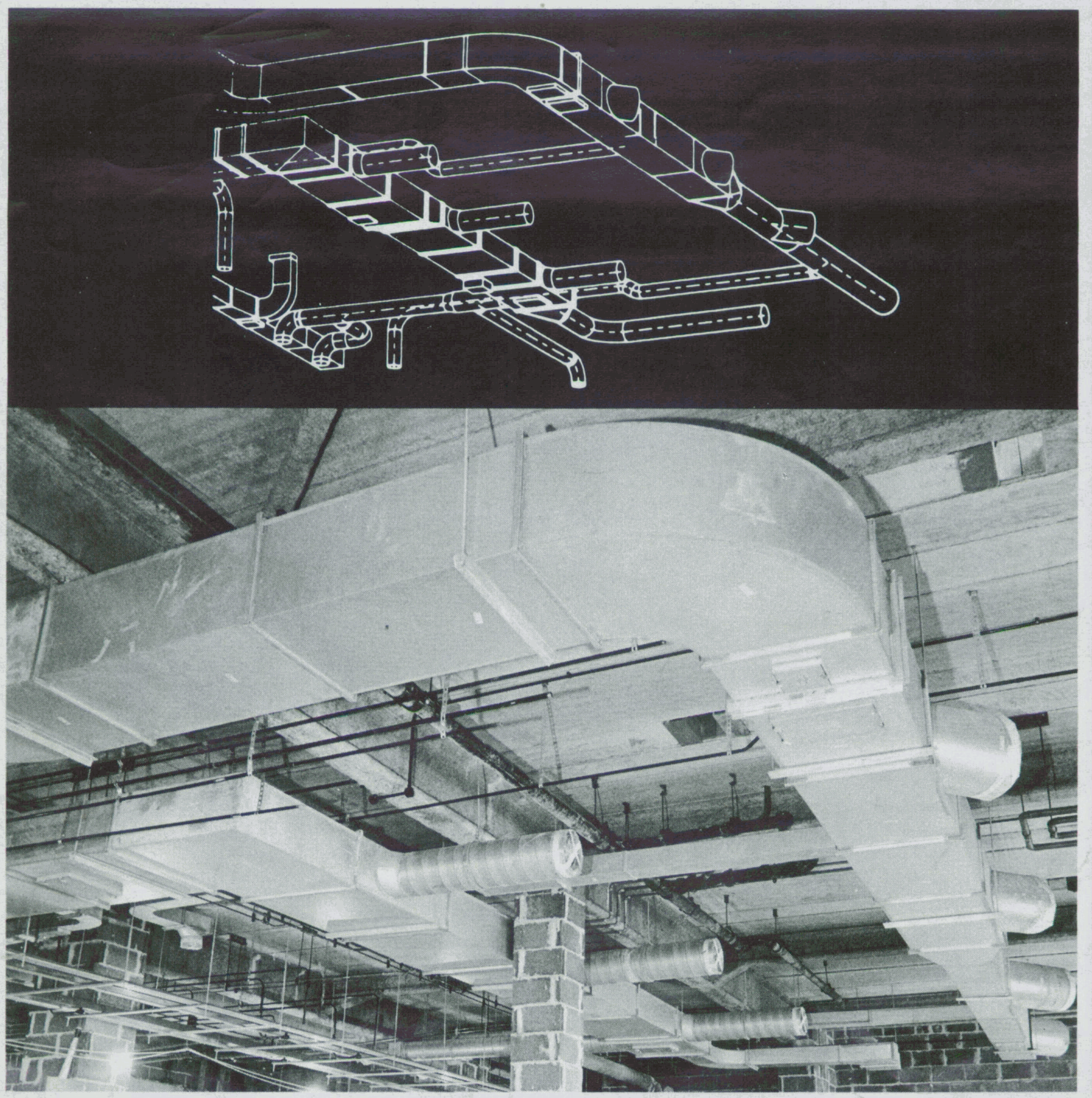
The Journal of the Institute of Hospital Engineering

October 1982

HOSPITAL ENGINEERING



Computer-aided design of ductwork

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HOSPITAL ENGINEERING

The Journal of the Institute of Hospital Engineering

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Volume 36 No. 8 **October 1982**

Front Cover: Ductwork design — on the computer; and the finished result.

Institute News

1983 Annual Conference

Members are reminded that next year's Annual Conference will be held at the Piccadilly Plaza Hotel in the centre of Manchester from the 11-13 May. Full programme and related details will be distributed to all members of the Institute during the first few days of next year.

The Lord Mayor and the Lady Mayoress will give a Civic Reception to delegates and their ladies on the evening of Wednesday 11 May, and the Conference Dinner Dance will be held in the hotel on the Thursday evening. It is anticipated that this last function will attract a record attendance.

It is hoped, therefore, that members have these dates firmly in their diaries.

New District Works Officer

In the August issue of *Hospital Engineering* we published a list of the fourteen newly appointed District Works Officers in the Yorkshire Regional Health Authority, leaving three vacancies still to be filled. The second round of interviews has now taken place and as a result Mr W. Pyle MIHospE, has been appointed District Works Officer with the East Yorkshire Health Authority.

Joint Scottish Branch Conference

The Joint Scottish Branch Conference will be held at The Walton Conference Centre, Southern General Hospital, Glasgow on 28, 29, 30 October, and well before you read this, the programme will have been despatched to all members of the Institute resident in Scotland.

Among those attending the Conference will be Mr John Bolton and Mr T. A. Nicholls of the Department of Health and Social Security, London, who, of course, are both Honorary Members of the Institute. The President of the Institute, Mr John Constable, very much regrets that personal commitments prevent his attendance.

All further information may be obtained from Mr T. M. Sinclair, 3 Morven Way, Kirkintilloch, Glasgow G66 3QL. Tel: Glasgow (041) 337 9696.

CEI Yorkshire Branch Annual Prestige Lecture

The CEI Yorkshire Branch Annual Prestige Lecture is to be given on Monday 22nd November in the Earl of Doncaster Hotel, Bennetthorpe, Doncaster at 7.00pm.

The speaker will be Mr D. Penny, CBE FEng FIMechE, Immediate Past President of the Institution of Mechanical Engineers, who has taken for his title 'Opportunities for Chartered Engineers'.

The Lecture is sponsored this year by the North Midlands Branch of the Institution of Mechanical Engineers.

Further details from, and application for tickets to Mr H. Etherington, CEng MIMechE FInstE Hon. Sec., CEI Yorkshire Branch, 114 Carleton Road, Pontefract, West Yorks. WF8 3NQ.

G. H. Tarlton retires

Mr G. H. Tarlton, FIHospE, recently retired from his post as District Engineer to the Gt. Yarmouth & Waveney Health Authority.

Mr Tarlton has completed 36 years service with the NHS and is a long serving member of the Institute, having been elected to membership in 1947. He has given loyal service to the Institute and was, for a number of years, Hon. Branch Secretary to the East Anglian Branch.

We are pleased that Mr Tarlton is to continue his association with the Institute and offer all good wishes for a long and happy retirement.

Welsh Branch — Retirements

The summer of 1982 has seen the retirement from long service with the National Health Service of three well known and active members of the Welsh Branch.

In June, Fred Beavan retired from his post as Engineer at Bronllys Hospital, Talgarth, near Brecon. Fred entered the health service 27 years ago after demobilisation from the RAF and became an Institute Member in 1957. His service has been exclusively with the Powys Health Authority and its predecessors. Fred is well known as a regular at Branch meetings, and members will be glad to know that he will continue as a member of the Committee, on which he has served for some years.

July saw the retirement of Jack Gillham from his post as Technical Officer with the Welsh Health Technical Services Organisation at Cardiff. Jack entered the health service in 1954, with the then Welsh Regional Hospital Board, as an X-Ray Technician, and can claim with some justification to have inspected every item of X-Ray equipment in use in the Principality during the period 1973-1982!

Jack has also been a member of the Society of X-Ray Technology since 1945, serving on their Council for two periods since 1961, and has been their National President on two occasions. He joined the Institute of Hospital Engineering in 1954.

In August Miles Gibbon retired as Assistant Area Engineer with Gwent Health Authority. He entered the health service in 1954 as an Assistant Engineer at the Bronllys Hospital and became a working colleague of Fred Beavan. He joined the Institute in 1955, and between 1956 and 1974 he served as Group Engineer and Deputy Group Engineer with the North Monmouthshire HMC, he retires after 28 years in the NHS. Miles is well known to members of the Welsh Branch as an active participant in Branch affairs, having served on the Committee for many years, as Chairman on two occasions.

Members of the Institute in Wales join their health service colleagues in wishing all three a long and happy retirement.

Forthcoming Branch Meetings

Southern Branch: *Hon. Sec: R. P. Boyce Chichester (0243) 781411*

25th November 1.30 pm	Visit to Fawley Refinery	

East Anglian Branch: *Hon. Sec: M. Brooke Great Yarmouth (0493) 50411*

12th October	Visit to Linby Colliery, Nottingham	
20th November	Visit to "All Electric" Hospital, Peterborough	

Midlands Branch: *Hon. Sec: W. Turnbull Birmingham (021) 378 2211 Ext 3590*

19th October	"Design Parameters and Application of Air to Air Heat Pumps" E. G. A. Godall Esq Trace Heat Pumps Ltd	West Midlands RHA
23rd November 6 for 6.30 pm	Air Flow Patterns in the Operating Theatre	Alexander McGreggor Theatre, Dental Hospital, St. Chads, Queensway, Birmingham

London Branch: *Hon. Sec: P. C. Vedast (01) 807 7340*

23rd November 6.30 for 7 pm	Optimum Energy Usage	Wolfson Lecture Theatre, The National Hospital

North Western Branch: *Hon. Sec: E. A. Hateley Manchester (061) 236 9456 Ext 452*

19th October	Visit to the Greater Manchester Fire Service Headquarters. Tour of the new Control Room and talk by the Fire Officer	

Scottish Branches Conference: *T. M. Sinclair Glasgow (041) 332 9696 — 3 Morven Way, Kirkintilloch G66 3QL*

28th, 29th and 30th October	Information Technology Year 1982	Walton Conference Centre, Southern General Hospital, Glasgow

Anyone wishing to attend any of the above meetings should contact the relevant Local Secretary.

The authors first presented this article as an Annual Conference paper.
Howard Elcock is Senior Lecturer in Politics at the University of Hull, Stuart Haywood is a King's Fund Fellow, at the University of Birmingham.

The Buck stops where?

Accountability and Control in the National Health Service

HOWARD ELCOCK MPhil MA (Oxon) PhD (Hull) and
STUARD HAYWOOD BA DFA AHA

Introduction

We have divided this paper into two parts. The first explores the relationship between the Department of Health and Social Security (DHSS) and Health Authorities in the context of a centrally financial service which is administered by decentralised agencies. The second explores the role of managers in decision-making and administrative processes in the NHS.

Central/Local Relations in the NHS

Formal responsibility for the NHS is vested in the Secretary of State and his Department. Under successive

National Health Service Acts the appropriate Minister (now the Secretary of State for Social Services) has been made responsible to Parliament for the provision of efficient and effective health services. The recent Royal Commission on the NHS recommended that this responsibility should in future be shared with Regional Health Authorities[1] but this was firmly rejected by the Government.[2] As already mentioned, the NHS is financed entirely by the Treasury, and the central government also controls, directly or indirectly, the appointment of the members of the NHS's governing bodies. The Secretary of State appoints the members of Regional Health Authorities and the Chairman of the Area Health Authorities. The remaining members of the AHAs are appointed by the RHA, but all members can be suspended or dismissed by the Secretary of State.

The traditional analysis of central/local government relations would indicate that, in this context, Health Authorities cannot be more than agents of the central government. Such local autonomy as does exist is purely the result of acts of grace and favour by the centre. Thus successive Secretaries of State have declared their support for local decision-making in the NHS. Patrick Jenkin has written that "We are determined to see that as many decisions as possible are taken at the local level in the hospital and in the community".[3] There is a long tradition of comparatively lose central control over the authorities responsible for the provision of health care. In his classic analysis of relationships between central government departments and local authorities, J A G Griffith said that the relationship between the Ministry of Health and local health authorities was a *laissez-faire* one, in which the local authorities were left free to innovate and learn from their own mistakes.[4] However, from the constitutional position it would appear that the DHSS could exercise much more firm control over the activities of Health Authorities if it chose to do so.

The Ultimate Sanction

However, the institutional position is not the only standpoint from which we can analyse central/local relations in the NHS. Another approach is to envisage the DHSS and the Health Authorities as independent political actors who each possess their own resources which they can use against other actors — including the central Ministry. In these terms, an accountability relationship becomes a continuous process, in which each actor attempts to influence or thwart the other. To say that Jones is accountable to Smith is indeed to say that Smith can instruct Jones what he should do but equally Jones has a choice whether to comply with Smith's instructions or resist them. If he decides to resist, Jones will employ one or more strategies of resistance which may include evasion, protest, making counter-demands or simply refusing to obey and daring Smith to do his worst. Smith in his turn must decide how to respond to Jones' disobedience. Despite his formally superior position Smith may have difficulty in doing so effectively. He may try to compel Jones to obey but his action may lead to public protest or even to damage to the service both are involved in providing. He may exhort Jones to do his duty but he has no guarantee that Jones will comply. He may dismiss Jones, but then he will have to engage Featherstonehaugh to do Jones' work, Featherstonehaugh will probably turn out to be no better — and quite possibly worse — than his predecessor. In any case, dismissal is only an appropriate sanction in extreme circumstances, and may be challenged, as did the members of the Lambeth, Lewisham and Southwark AHA when they were suspended for refusing to make spending cuts demanded by the Secretary of State.[5] Thus Smith cannot be sure that the can overcome Jones' resistance.

Policy Initiatives

Our research into the relationship between the DHSS and eleven Health Authorities in the North of England amply demonstrated the validity of this model.[6] We examined the impact of two DHSS policy initiatives on the Health Authorities in our study.

The first was the attempt to redress the long-standing maldistribution of health care resources between different parts of the country by applying the formulae devised by the DHSS's Resource Allocation Working Party (RAWP). Under these formulae the DHSS allocated funds to RHAs who were then supposed to allocate funds to AHAs using the formulae. AHAs in their turn were to apply the formulae in making their allocations to their Districts. The impact of RAWP was limited by strategies devised by the Health Authorities to resist an unwelcome instruction from the DHSS. One RHA pleaded that it was committed to an extensive programme of capital developments which committed it irrevocably to a pattern of resource allocation which would be inconsistent with RAWP. One AHA (which had better remain nameless) reinterpreted the RAWP calculations so that its richest District became it poorest and the poorest the richest, so justifying an unchanged pattern of resource allocation!

The second policy initiative whose impact (or lack of it) we studied, was the attempt to improve provision in traditionally deprived fields of health care (geriatric care, primary care and the care of the mentally ill and handicapped) at the cost of restraining growth in the acute and maternity sectors. The DHSS itself reduced the effect of its own policy statements by issuing them late with the result that RHAs had commenced their policy planning before DHSS guidance became available. In any case, a study of two Regional Strategic Plans showed that one RHA was unwilling to implement the policy and pleaded that it could not do so because of extensive capital commitments to acute high-technology medicine. The other RHA was more enthusiastic about the policy, but felt able to implement it only by using resources released by rationalisation and the promotion of greater efficiency in the acute and maternity sectors.

Passing the Buck

In general, the decentralised agencies were unwilling themselves to take unpopular decisions, for example on hospital closures or changes of use, preferring to pass the responsibility to higher authorities and ultimately to the Secretary of State. One is reminded of Butch Cassidy and the Sundance Kid running out of ammunition while under heavy fire and having to run for more. "I'll go." "No, I'll go." "This is no time for heroics. You go".

In failing effectively to implement central policy initiatives, Health Authorities were responding to other pressures from within their own organisations which were more insistent than those from the DHSS.

The Role of Management in the NHS

The role of managers, is to provide the 'skeleton' of arrangements for public accountability in the NHS. A prerequisite of an effective system of accountability is a clear view of what health service managers can actually do, without it, expectations of performance may be unrealistic.

Considerable significance is now attached to managment in the NHS, though this was not always the case.[7] A topical example is the intense interest in management arrangements for health authorities. In the case of works officers, decisions on the nature and lines of accountability between them and unit works personnel, are held to be crucial factors in the quality of estate management. The protagonists seemingly believe that the managment of the estate will be noticeably worse or better if unit works officers are (not) made accountable to the unit administrator, rather than the district works officer.

The consuming interest in district management teams (DMTs) and arrangements for senior, district level posts is another manifestation of the same phenomenon. The DMT's style of operation, composition and preferences are clearly thought to be a crucial factor in the quality of local services. The supposedly supreme significance of senior managers for the effectiveness of the organisation flows from the devotion to hierarchical principles in the NHS. It finds expression in many official documents. For example:

"Higher organisations must be designed to produce policies within which local services can be managed effectively. Higher levels of management should, therefore, agree objectives with lower levels as the basis for delegating authority and for monitoring performance . . ."[8]

The familiar 'top-downwards' notion of organisational process is also very evident in descriptions of the planning systems.[9] With health authority members (whose actual influence on events has been negligible[10]), management teams

"have a special responsibility for ensuring that those engaged in planning, firstly examine thoroughly the significant problems and opportunities in their spheres of activity, and secondly, receive guidance on resource availability so that they can plan realistically. The role . . . is essentially strategic, and they should avoid involvement in details of planning at the operational level . . . The final responsibility for the plan, however, resides in the team, who have to decide between proposals from the different planning groups."[11]

There is no evidence that these and kindred beliefs in the potency of management will be in any way diminished by the latest reorganisation, in spite of the references to its 'supportive' rôle in *Patients First.*[12] The effect of the current change is to reinforce further the belief that improvements in service can be profitably sought in changes in the management system. The strength of this belief is amply illustrated by the amount of time devoted to consideration of alternative management arrangments and the intensity of many local tussles about them. The continuing debates on access to health authorities for senior officers who are not team members, and relationships between district functional managers and unit personnel, testify to the overwhelming importance attached to management in general, and the position of senior management in particular.

It is worth noting in passing that there have been more cautious official appraisals of the potential contribution of management, and, therefore, the impact of changes in management arrangements on organisational performance. In the context of the present reorganisation, the previous Secretary of State himself referred to the additional need "to find ways of changing attitudes and methods of working."[13] He recognised that the new management arrangements were insufficient in themselves to effect the improvements that he saw necessary. Similar notes of caution can be found even in the (in)famous 'Grey Book', which seemingly heralded the new age of managerialism:

"Management plays only a subsidiary part, but the way the service is organised and the processes used in directing resources can help the people who play the primary part."[14]

In spite of these notes of caution, the high levels of investment in 'management' (structures, processes, techniques, training etc.) have raised expectations of the management contribution to the NHS. These expectations have been raised further by the theoretical sources for many of the changes. The theories assume a central role for management, and the pre-eminence of senior managers. Already high expectations are further reinforced by the self images and aspirations of many senior managers themselves.

There is now a danger that conventional theory' about management roles and aspirations are uncritically assumed to be the reality, or at least a desirable state of affairs for the NHS. A consequence of this is ill-informed expectations of management in general and chief officers in particular. This process works in two different directions. First, it raises expectations (and thereby informs allocations of responsibilities and arrangements for accountability) beyond the level of possible performance. Second, it deflects attention away from areas of activity in which managers could be legitimately expected to do much better than they have been doing in the past.

Another look at the reality of the 'top-downwards' view of organisational process is a useful place to start any rethink of the senior manager's role and the general impact of management in the NHS. It remains an influential notion in practice, underpinning, for example, the belief that top managers are, or should be, pre-occupied with policy issues, and lesser mortals primarily concerned with implementation. For this view of the world to correspond with reality, senior managers have to have extensive control over choice of developments within health authorities. Otherwise, the notion of developments being the result of policy devised and initiated from the top begins to look a little thin.

The doubtfulness of the basic premise becomes evident from only the briefest of reflections on how the NHS actually works. Expenditure is generated by doctors. General practitioners control the access of patient to hospital care and consultants in their turn control access to the use of diagnostic, therapeutic and hotel services. The aggregate of these individual clinical decisions (with differential inflation) offer far more convincing explanations of the changing pattern of hospital spending in the mid-1970s than do the preferences and plans of district management teams. *(See figure 1)*

Support for a less heroic view of the impact of senior managers has also come from studies of teams in action. One clearly demonstrates the preoccupation of management teams

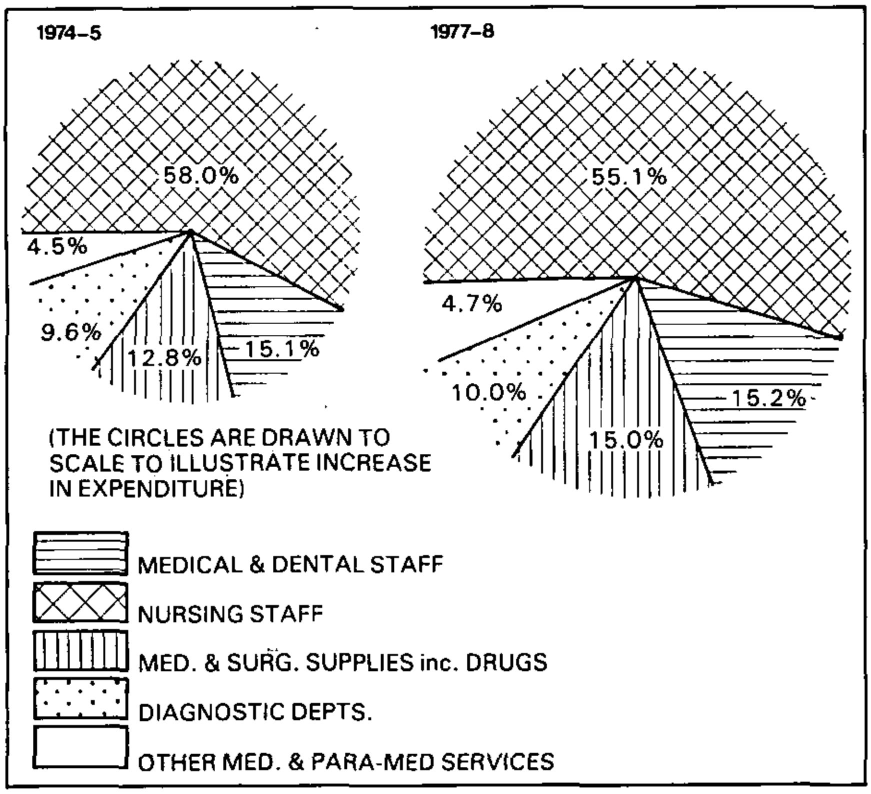

Figure 1 Source: R Spencer Pathology: A Suitable Case for Management Intervention. 1981. Obtainable from Health Services Management Centre, University of Birmingham.

with the exchange of information unrelated to any immediate decision, the allocation of responsibilities and the processing of issues, and routine decisions (e.g. study leave).[15] This study suggests that the essence of the senior management contribution in the NHS is the processing of business in ways which do not *disturb the equilibrium of the* organisation and/or command the support of the most powerful groups within the DHA. The idea of chief officers preoccupied with major policy issues, strategy and directing developments was similarly not very apparent in Rosemary Stewart's study of district administrators.[16] The impressions of senior management roles in both studies, reinforced by our other research activities, gain further credibility from reflections on power in the NHS. Managers are clearly not the most powerful group in the health authorities.[17] If this is accepted, expectations based on the notion of a senior management wholly 'responsible' for the pattern of local developments are unrealistic. A more realistic test of senior officer competence is the smoothness with which the organisation runs.

The over estimation of the significance of management for organisational effectiveness has had another unfortunate by-product. This is the considerable time and energy devoted to such issues as size and boundaries of the new district health authorities and the relative merits of functional or 'product' management. If management arrangements are less potent *forces* than conventional wisdom would have us believe, then some of this time and energy could have been more profitably deployed on other issues. The misdirection of energy is further compounded by the doubts about the links between these factors and management performance. For example, *research for the Royal* Commission or Local Government in England, on the impact of different size and boundaries, on the performance of different local authority services, failed to demonstrate significant correlations between them.

Expectations of senior management performance does not, however, have to be revised downwards in all directions. In some ways I think it is legitimate to expect more of them in the future, not withstanding earlier passing comments on power. Managers can use the power they have to better effect. For example, they should direct attention increasingly to the *performance* of departments, units and the health authority as a whole and away from the still all pervading concern with inputs. In the case of work staffs, for example, we hear a lot about how many tradesmen and managers are, or are not required, but far less about measures of output, the quality of work and the relationship between inputs, quality and outputs.

Senior managers can do much more to make choices (in which the preferences of others are, nevertheless, dominant) more explicit and informed. People with influence and power must increasingly be made to recognise opportunity costs of ongoing commitments, as well as alternative uses of the increment. This applies not only to big issues like body scanners, but also to lower than necessary levels of productivity. For example, an 'over-staffed' works unit 'costs' improvements in clinical services.

Since there are now many analytical techniques to make choice better informed, we can also legitimately expect a greater use of them in the future. It is a reflection on the NHS that we had to wait so long for the formal incorporation of an investment appraisal procedure in our capital planning system.

Conclusion

On balance, this review of the manager's role in the NHS suggests that we can legitimately expect more particularly as they have now been *promised* the decentralisation for which they have long campaigned. However, improvements depend on a sense of proportion about the potency and validity of management wisdoms. Structures, management arrangements and decision making processes — at least in their present state of *development — may be less potent* in the NHS than the intensity of debates about them would suggest. Improvements will also depend on realistic appraisals of what managers can actually do. I have argued against the uncritical application of the policy maker/directorate model of role for senior managers, since they have not sufficient control of activities to sustain it. Rather, higher expectations should be directed to management efforts and effectiveness in getting others to concern themselves with the crucial issue of standards of performance.

References

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3. Ibid. Introduction by Patrick Jenkin, para 5, p 2.
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5. *The Guardian* 26 February 1980.
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9. Department of Health and Social Security *The NHS Planning System* June 1976.
10. S C Haywood and A Alaszewski op cit.
11. *The NHS Planning System* op cit paras 1.4 and 1.5.8.
12. *Patients First* op cit Foreword.
13. *Speech to annual conference of Institute of Health Service Administors* July 1980.
14. *Management Arrangements for the Reorganised Health Service* op cit Para 1.1.

Mr Ratcliffe is the Assistant Chief Engineer at the Department of Health and Social Security. His paper was originally given at the International Federation of Hospital Engineering's Focus on Appropriate Technology *Seminar, held at the Hospital Estate Management and Engineering Centre at Falfield.*

A Review of progress on System Hospital Building — Nucleus

S RATCLIFFE CEng MICE MIMechE FIHospE

Introduction

In 1973 as a result of the then oil and financial crisis the Department undertook the planning and production of material for the Nucleus Hospital. The work has been described at the various annual conferences of the Institute of Hospital Engineering by myself and others from time to time. Papers have also been given before the various branches on the same subject. It is now some time since a paper was last presented and it seemed appropriate therefore to offer a short description of the state of the art at this moment.

The Nucleus Concept

As the Nucleus Hospital Concept has been described comprehensively in the past both in papers before learned institutions and in various publications, it would be repetitive to repeat the process here. A working knowledge of Nucleus is therefore assumed. Despite this assumption there are a few basic policy decisions which need to be borne firmly in mind when surveying Nucleus progress over the last few years. They are —

(1) The Nucleus Hospital was always seen as embodying current policies within the Health Service as printed in guidance issued by the Department. For example the Nucleus Data Packs are put together using the Hospital Building Notes, the Hospital Technical Memoranda and other like documents. They also envisage the fullest use of MDB components.

(2) The scope and content of the Nucleus Data Packs were very carefully agreed with the National Health Service before work commenced. A central feature of this agreement was, and is, that the Data Packs would not in themselves be adequate for tender purposes. To put this another way any user would need to take the Data Pack material and from that produce his own tender documentation. For example the engineering exists as single line drawings with the major coordination carried out. It is vital to produce double line drawings from these and ensure that the minor coordination is also completed.

It will be appreciated that the success of a given project will be determined by how thoroughly the Data Packs have been converted to tender/working drawings. The effectiveness of this work will be apparent both financially and technically.

(3) It will be remembered that the original list of Nucleus Departments comprised:

Adult Acute Wards, Theatres, X-ray, OPD, AE, Pharmacy, Rehabilitation, Administration, Catering, HSDU, Stores, Workshops, ITU, Mortuary and Satelite Laboratory.

It was also decided that no Data Pack would be produced unless at least two projects were clearly seen to be needing that particular pack.

This original stock has served us very well as shown by the fact that only three more have needed to be added, ie.

(1) Paediatric Department
(2) Maternity Department
(3) Geriatric Department

and these three Data Packs are now available and in use.

In additon to these three a need has been shown for two more which are currently under protection. These are
(1) Day Hospital for the Elderly
(2) Mental Illness Department
At the moment there are no plans for producing any other departmental packs.

Projects

As might be expected and hoped a number of Nucleus projects have been put in hand over the last few years. Some are complete and occupied, some are under construction and others are in the planning stages. A few of the earlier ones are:
(1) Pinderfields — 52 bed adult acute ward unit. Single storey. Completed in October 1980 and now in use.
(2) Lister Hospital — Maternity Unit. Now under construction. Due for completion in 1983.
(3) Bradwell Hospital — Geriatric Unit. In the planning stage. Due for completion in 1985.

These three products have all been undertaken with varying degrees of DHSS involvement so that we may test the Data Pack material as early as possible before it becomes incorporated in too many major products.

A number of complete hospitals are also in the final stages of construction. They are as follows:
(1) Chester DGH completed January 1982.
(2) Newham DGH — due for completion Autumn 1982.
(3) Redhill DGH — due for completion Autumn 1982.
(4) Maidstone DGH — due for completion early 1983.
(5) Macclesfield DGH — due for completion 1983.
(6) Croydon (May Day) hospital — due for completion 1983.

These are some of the Nucleus Hospitals currently under construction and in a fairly final state of completion. In addition to these there are approximately 48 more in the planning stage and expected to commence construction in the next six to eight years.

The Use of Nucleaus Material

When first developed it was anticipated that users would simply take the published Data Pack material and work this through to tender documents thence construction stages. The Data Packs were put together with the fairly certain knowledge that some local trimming would need to be done to suit particular circumstances in individual hospitals. As things have turned out the use of Nucleus material has been much wider than any of us envisaged initially. At one end of the scale users have take the Nucleus Data Pack and simply translated that to tender documentation without making any changes whatsoever. At the other end of the scale the Nucleus policies have been abstracted from the Data Packs and themselves used to generate new designs. Between these two limits we have seen all manner of combinations and permutations.

Execution of Nucleus Work

The Nucleus Data Packs were produced in such a form that they could be taken up, amplified and used by any design team reasonably versed in this sort of work. Experience has shown that the designs have been executed by all conceivable combinations of design teams. Successful partnerships have been established between the various professions employed within the National Health Service and the members of the various professions practising privately in commerce. All appear to have been equally effective.

One development which was not envisaged when the Nucleus Data Packs were planned was the use of management contracting. The Mersey Regional Health Authority obtained Departmental approval to appoint management contractors for the new district general hospital at Chester and also to seek conventional tenders for another similar Nucleus Hospital at Macclesfield. The Chester project is now physically complete and being commissioned whilst the Macclesfield job is under construction. This development is of extreme interest to us all and is currently the subject of a comprehensive evaluation study the results of which will be published in due course.

We keep abreast of developments in the systems building industry continually as it was always considered that this might have potential for Nucleus projects. Considerable studies have been carried out over the years as to what benefit could be obtained by using proprietory buildi systems in the construction of Nucleus Hospitals. As might be expected the results vary considerably depending on which particular system building method is studied. The one single lesson which seems to come through consistently is that the Nucleus building module does not fit any of the building systems produced to date. This then means that it would be necessary either to alter the Nucleus building module — which would destroy all the planning, or it is necessary to change the system building module which would wreck any benefits to be obtained in that direction. The Nucleus building programme, large as it is, is not sufficiently big to warrant the development of a building system for its own particular purposes.

Evaluation

It would clearly be imprudent to embark on a programme like Nucleus without recognising the need for evaluation of results and feedback into the original material to ensure the elimination of any errors which occur and the improvement of the designs. This was clearly recognised when Nucleus was conceived although the design and execution of the system was shelved until resources could be brought to bear on the problem.

Quite early on in the Nucleus programme we set up a small clearing house in Euston Tower to receive feedback from projects as they were under construction, sift the intelligence received, and make amendments to documentation if and where considered necessary. Recognising that it would take much time and money to amend and reissued the Data Packs we embarked on a programme of producing Nucleus information bulletins two or three times a year. These are easily and quickly produced and thus form a convenient and inexpensive means of alerting users to changes which may need to be incorporated in any designs being put together.

In addition to the Nucleus Information Bulletin we also have done a fair amount of evaluation at Pinderfields on behalf of all disciplines. It was felt essential to carry this work out as quickly as possible at it relates to an adult acute ward which of course is a very major portion of the entire building programme.

Now that a number of complete Nucleus Hospitals are approaching occupation, work has been going on within the Department and with the

National Health Service to decide how best these can be evaluated across the board. A project evaluation group has been set up jointly with the National Health Service, embracing all disciplines and this group is actively pursuing the most effective method of evaluating Nucleus Hospitals with a view to starting work on the first ones as they become available.

Updating arrangements

Over the last two or three years the desirability of ensuring closer links between the hospital Building Note production and the Nucleus guidance has become increasingly clear within the Department. To this end we now have a joint programme linking the production of building notes to that of the updated and/or new Nucleus Data Packs. It will be appreciated that in order to produce a Building Note it is necessary to put together a design which can be tested for viability and also costed. In the case of some departments eg Catering, it is necessary to test a number of designs of different sizes of department. For a year or so now this has been run together with the Nucleus work. This means that when a Nucleus or building note team produce a Departmental design it is in a form suitable for use by both teams. That is, the building note team produce designs which can be incorporated in Nucleus Data Packs and conversely the Nucleus team produce designs which can be used for Building Note purposes. By this mechanism it is planned to update current Nucleus Department and also to set about producing alternative sizes of existing Nucleus Departments where these should be needed. In addition to this we are in receipt of designs produced by Regional Health Authorities, of the information fed into the Nucleus Information Bulletins mentioned earlier and from all these we are able to formulate an updating policy for the Nucleus work.

Overseas Use

Although the Nucleus Hospital was designed entirely for use in the National Health Service it was recognised that it might have some applications abroad. To that end wherever possible decisions were made which would not inhibit its use overseas. For example a pilot study was carried out to show that a Nucleus Hospital could be satisfactorily air conditioned without increasing the services space above the false ceiling.

The Nucleus material has proved to be of interest and value to overseas Governments and also to private practices involved in designing hospitals abroad. One example which comes to mind is the new hospitals currently being planned for Jordan. This relies very heavily on Nucleus material developed for use in our own country.

The author was the Cadcentre Project Leader on the Hargreaves Development Project. The Computer Aided Design Centre is an industrial research department of the Department of Industry.

The article was first published in Chartered Mechanical Engineer.

COMPASS — ductwork design and manufacturing system

D L DUFFET MA

COMPASS (Computer Orientated Manufacturing, Production and Scheduling System) has been developed jointly by the Computer Aided Design Centre, Cambridge, and Henry Hargreaves & Sons Ltd, Bury. Hargreaves are ventilation engineers who are responsible for the design, manufacture, and erection of ductwork on building contracts. They are the largest manufacturers of ductwork in Europe, and are part of the Senior Engineering Group.

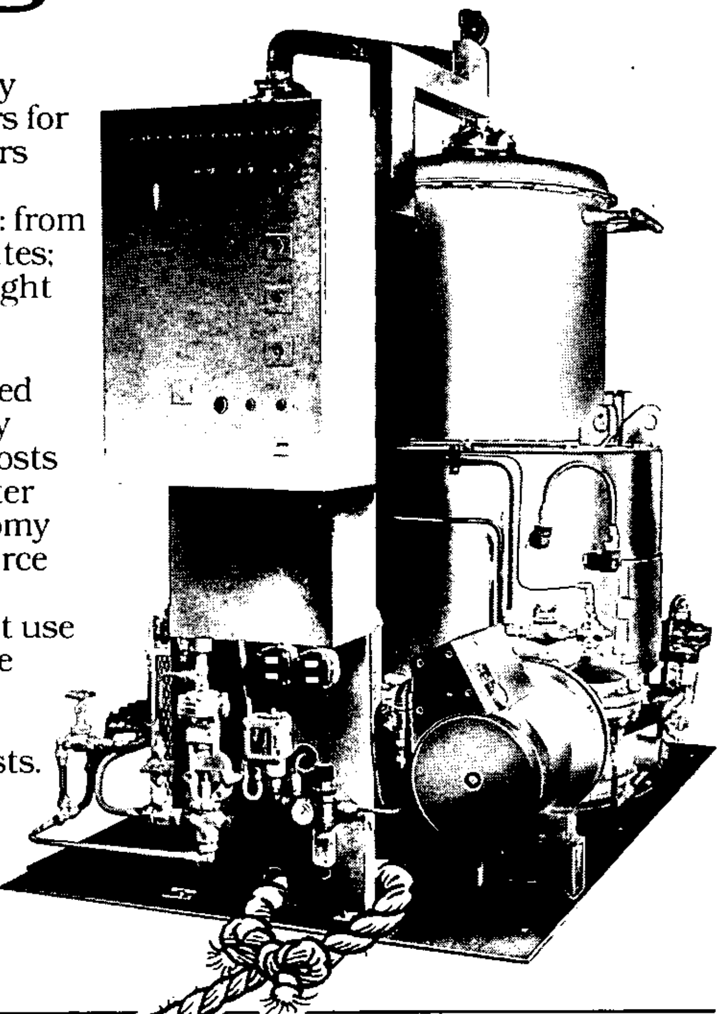
As a result of a study undertaken by a team from the University of Manchester Institute of Science and Technology, Hargreaves committed themselves to the introduction of computer-aided design (CAD) techniques to improve efficiency. The study had identified a clear need for a 3D modelling capability, to enable the production of fully co-ordinated, clash-free drawings. At this time, Cadcentre had acquired considerable expertise in this field through the development of PDMS (Plant Design Management System). Hargreaves decided to use Cadcentre to jointly produce a customised ductwork design and manufacturing system based on the same technology as had been used in PDMS.

During the joint development of COMPASS, the two parties have co-operated very closely. Hargreaves have provided the engineering expertise relevant to their industry, while Cadcentre have provided the experience in the field of computer-aided design. The result has been a sophisticated CAD package which meets the user's real needs.

Background

In this country, it is standard procedure for any organisation undertaking a large building project to employ consultant engineers. These consultants have responsibility for areas such as ventilation, electrics, water, and fire detection. For the ventilation system in a building, the consultant will produce a conceptual design, based on calculations of air volumes, pressures, duct sizes, and other parameters. His main aim is to design an efficient system which is cheap to install and run. However,

The British boiler industry is back in the Stone age.



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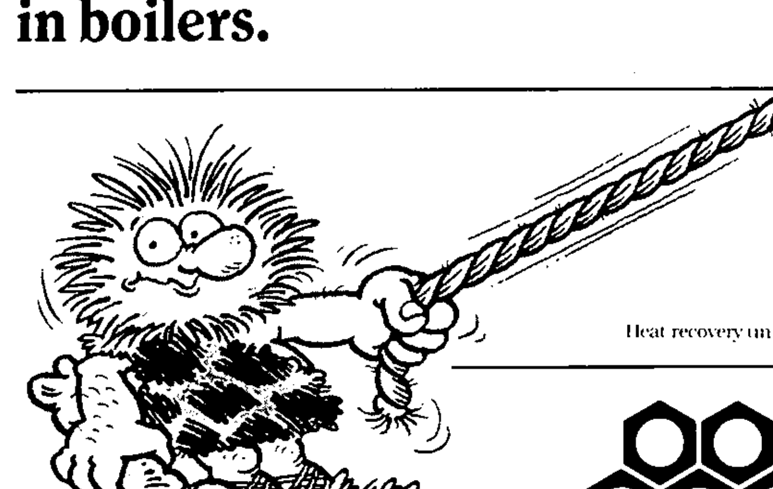
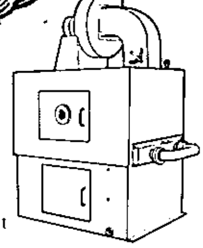
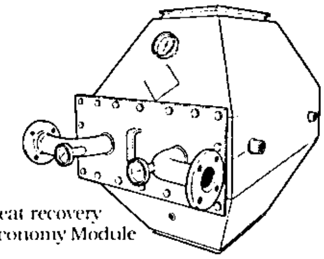




Heat recovery unit



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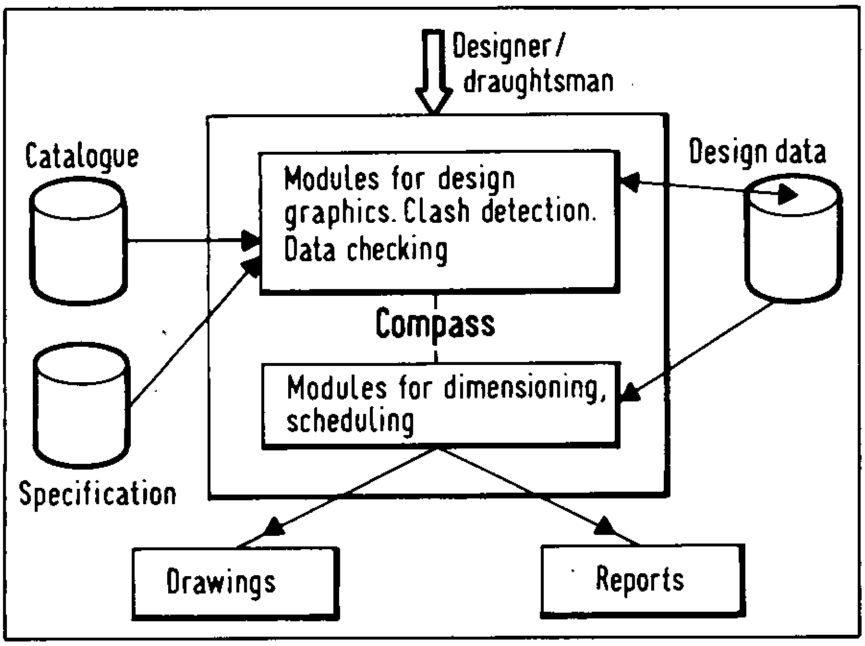


Figure 1: Compass structure.

the final design work is performed by sub-contractors such as Hargreaves. In the context of this paper, the word 'design' refers to the layout and finer detailing functions, for which Hargreaves are responsible, rather than the initial conceptual design. Having produced a detailed ductwork layout, they manufacture the ductwork, and finally erect it on site.

The Hargreaves draughtsmen work from consultants' drawings when producing the final design. Because of the other services involved, and the frequent need to arrange a number of ducts within a limited space, co-ordination is a major problem. Clashes between ductwork or with structure or other services can be very costly. If these are not detected before erection on site, much time and money may be wasted in rectifying the errors.

Description of Compass

COMPASS is an integrated system used by draughtsmen at all stages of the design process. It is a design aid which reduces the tedious aspects of drawing, but retains the creative aspects of a draughtsman's work. Instead of working at a drawing board, he builds up his layout at a computer terminal. By use of simple commands, he creates a 3D model of the structure of the building and the ductwork within it.

Using the interactive graphics facilities, he can view any portion of his layout from any angle. He may, therefore, produce isometric views extremely quickly. There are also facilities for perspectives and for the removal of hidden lines.

There are extensive error-checking facilities, but no attempt is made to rectify errors automatically. The draughtsman has the responsibility for modifying his layout to remove errors detected by the system.

The output comprises fully dimensioned drawings and manufacturing, timing, and purchasing documents. When a layout is complete, the user is able to add dimensions and annotation to his final drawing. The 3D model of the ductwork and structure is held in database files, and this design data is transferred to a serial file to allow manufacturing take-off. The documents produced are suitable for use on the shop floor, since they contain all the necessary manufacturing information.

The manual design sequence

Under the manual system for producing ductwork, Hargreaves divided the drawing activity into two distinct phases — layout and detailing. These tasks are performed in different drawing offices. The layout drawings are produced by draughtsmen with reference to the working drawings of architects, consultants, and other engineers involved in the building. There may be special customer requirements which also need to be considered. A drawing does not pass on to the detailing stage until it has received customer approval. Detailing involves the division of the duct network into individual components which are given identification numbers. At this stage it is desirable to maximise the use of standard components to reduce manufacturing costs.

Ductwork components are manufactured from sheet metal, and come in three cross-sectional shapes — rectangular, circular, and flat oval. The link from design to manufacture involves the production of shop floor instructions to cut and form sheet metal into the appropriate shapes. This scheduling function begins with the classification according to component type, shape, joint types, and other design parameters, of every manufactured component on the drawing. Similar components are grouped together and allocated identical 'schedule numbers'. Programs are then run on a desk-top calculator in order to generate detailed manufacturing data. At this stage, documentation is also generated for use in requisition of materials, transportation, and finally erection of ductwork on site.

The use of COMPASS in the design process

Definition of component catalogue and design rules.

Draughtsmen creating a design need to have access to a catalogue of standard components. In COMPASS, this catalogue is held as a data-base (ie, a structured file) on disc. Therefore one of the initial tasks is to create this catalogue data. For each ductwork component, a 3D geometrical model is build up out of standard primitives such as boxes, cylinders, tori, etc. This model is used to give a geometrical representation of the component on the drawing, and to provide parameterised dimensional information. In general, catalogue components do not have a fixed size, and dimensions are dependant upon parameters defined at the design stage — for example length or radius.

The task of creating a catalogue will only need to be performed once by an organisation using COMPASS, although modifications and additions will be required as manufacturing technology and standards improve. The draughtsman producing a drawing requires no knowledge of how to set up the catalogue, and in fact will not

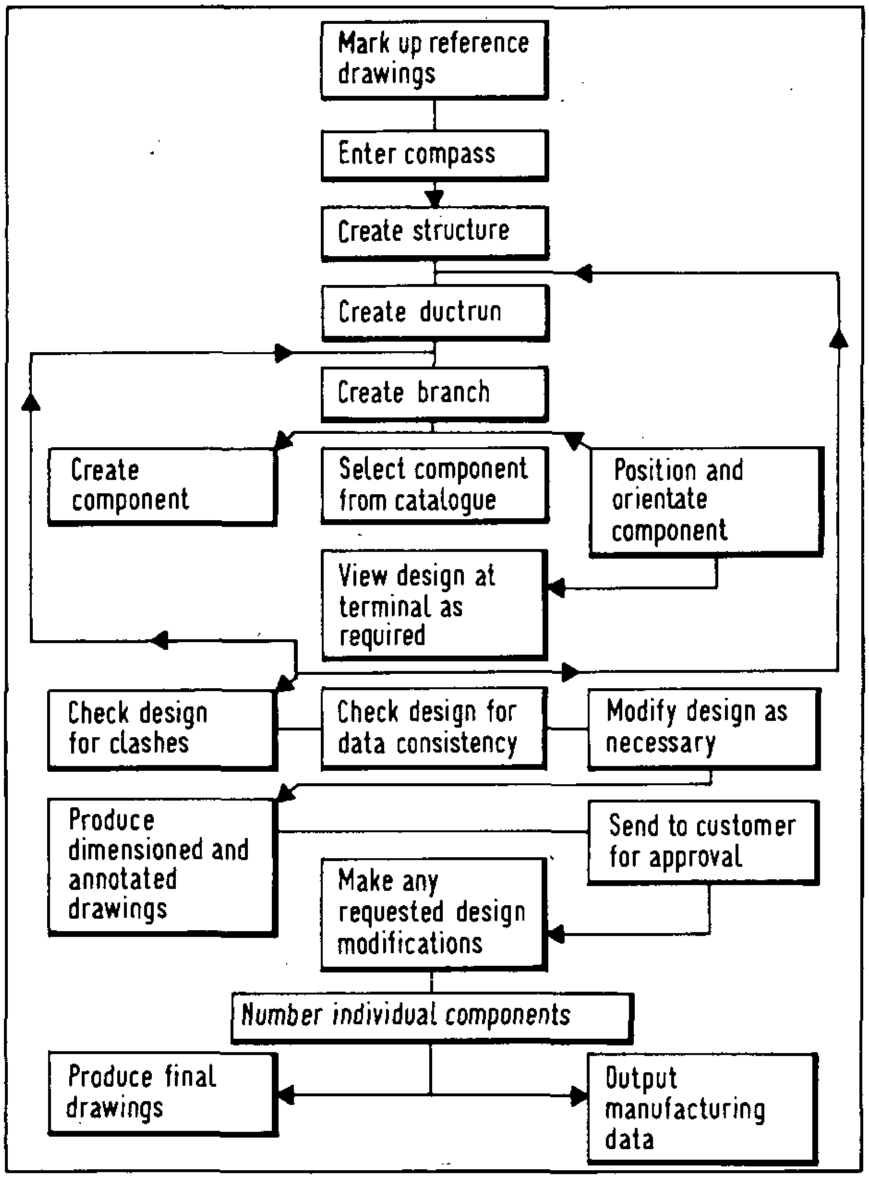


Figure 2: The process of ductwork, using Compass.

be allowed to modify it. This is the task of a system administrator.

As a complement to the catalogue, the system also provides a specification facility. This allows design and manufacturing codes of practice to be held in the system. These codes are defined in terms of a table, which is input to the system at the beginning of a contract. According to the values of certain component parameters — for example cross-section or radius — the table defines the particular catalogue component to be used. Manufacturing restrictions, such as maximum permitted cross-section dimensions, can be held in the specification and will be common to all contracts. However, there is the flexibility to incorporate any special customer requirements for a particular contract. Like the catalogue, the specification structure is hidden from the draughtsman and he will not need to modify it.

Detailed design.

When a draughtsman begins a new drawing, the specification and catalogue data will have been set up and are, therefore, available for his use. Working from marked up consultants' drawings, he first defines the structure of the building, including columns, walls, slabs, and restricted zones. These are created and positioned using simple commands. At this stage, the draughtsman also defines grid lines, required for reference when positioning items. The 3D capability allows him to verify his input by viewing the structure from any angle on a graphics screen. When he is satisfied that this structural input is complete and correct, he moves on to the next stage in the design process — defining the ductwork.

In the manual design process, the functions of ductwork layout and ductwork design are separated. COMPASS combines these into a single function, with the draughtsman designing individual components from the start. The only exception is *that straight duct runs, and lengths* of flexible ducting, do not need to be defined explicitly since there are automatic features to generate these.

Any ductwork layout contains a number of branches. Each branch contains a number of connected components and has a start and an end point, known as the 'head' and 'tail' of the branch. The draughtsman using COMPASS builds up his design one branch at a time, although there *are facilities for making copies of* branches.

For each branch, the draughtsman first defines the positions of the head and tail. He also defines some other branch parameters, such as its shape and the cross-section dimensions at the head and tail. He then designs each component in the branch in turn. Having defined the component type and other relevant parameters, such as length and off-sets, he uses a single Select command, which automatically selects the correct catalogue component for the situation. The rules for selecting components are held in the specification and catalogue. Joint types are typically dependant upon the shape of the branch, its cross-section dimensions, and the velocity of the air which the ductwork is designed to pass. Having positioned the first component at the head of the branch, subsequent components are selected and then linked using Connect commands.

The draughtsman has many other design facilities available to him, enabling him to build up the design quickly and accurately. However, the system does not automatically arrange the ductwork within the available space. It is a tool which complements the draughtsman's skill and experience.

At any stage in the ductwork process, the draughtsman can verify his design by displaying a portion of it on a graphics screen. by using a number of selected views of the ductwork and structure, he can very quickly detect any obvious errors.

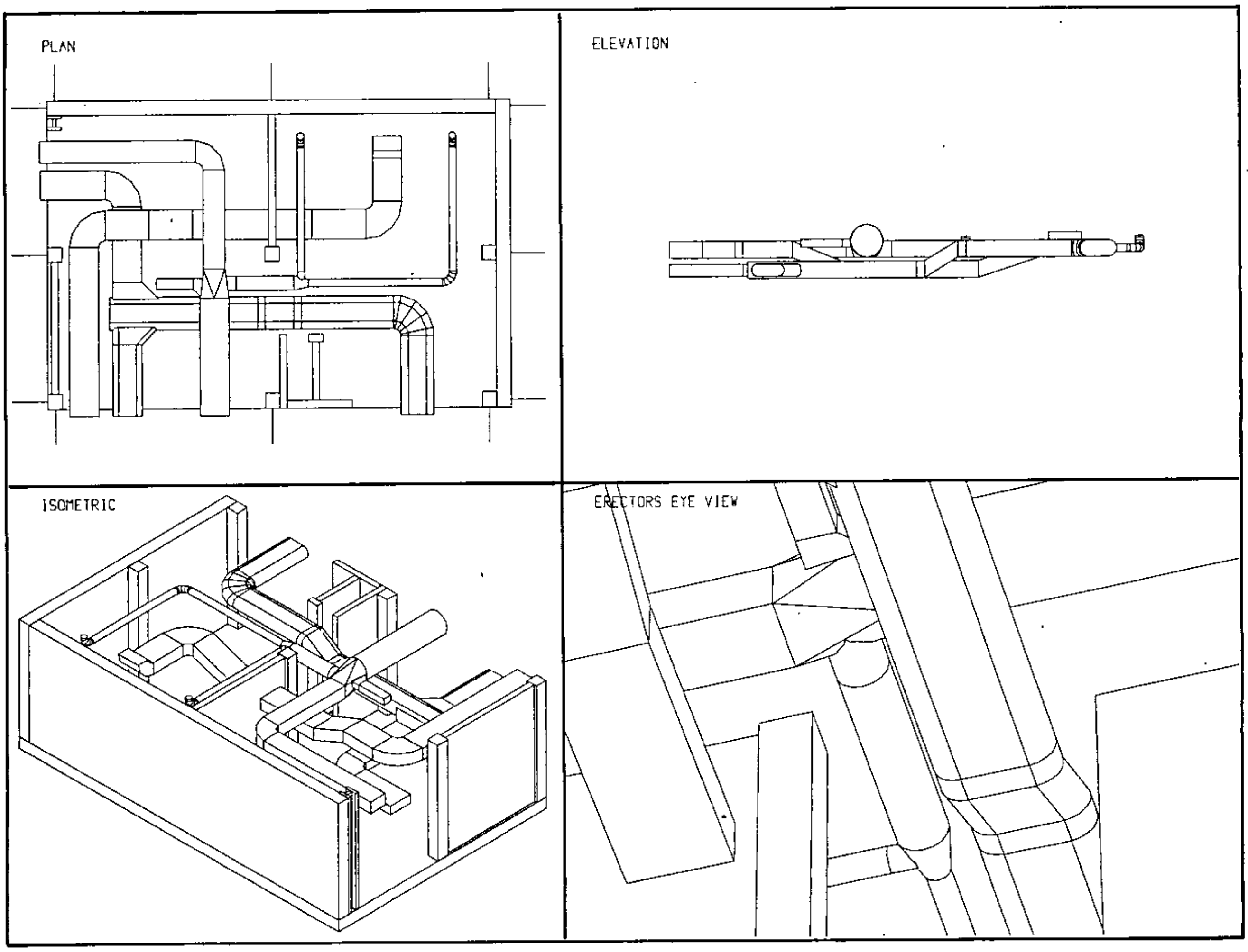
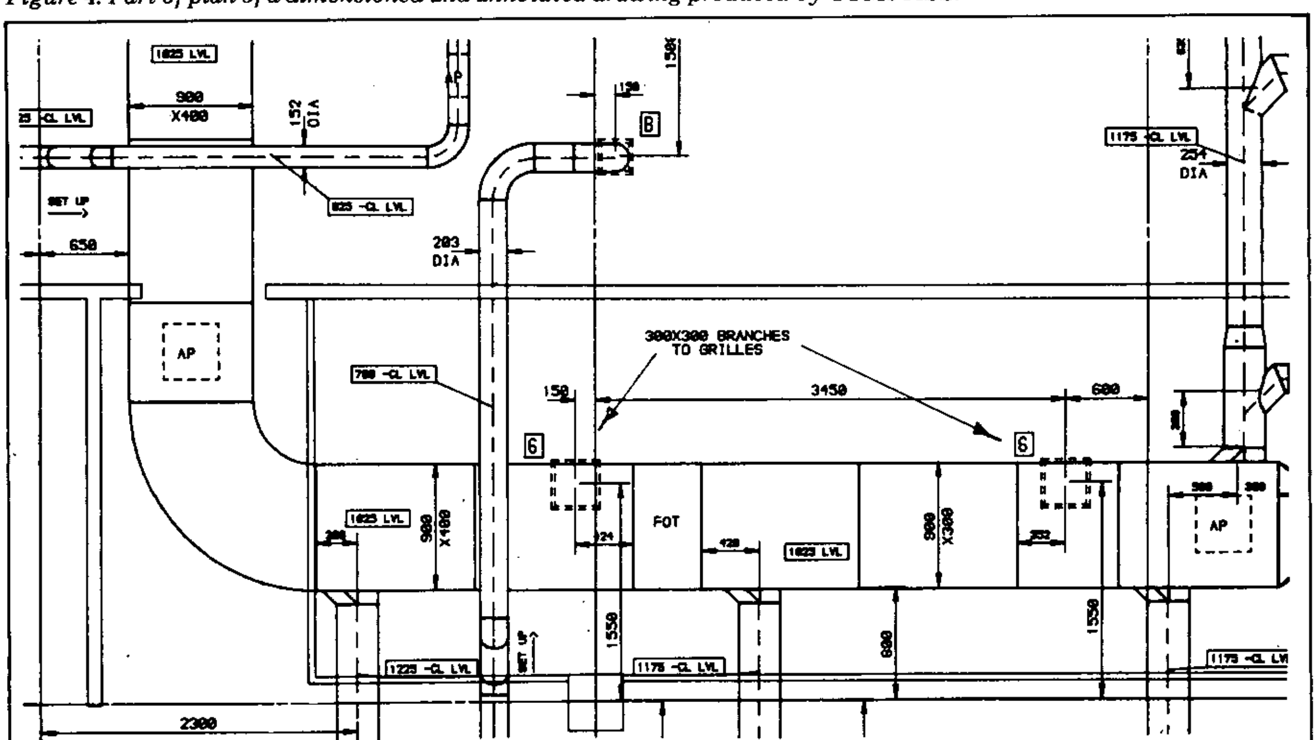


Figure 3: Plan, elevation and isometrics of a single area of COMPASS design.

Figure 4: Part of plan of a dimensioned and annotated drawing produced by COMPASS.



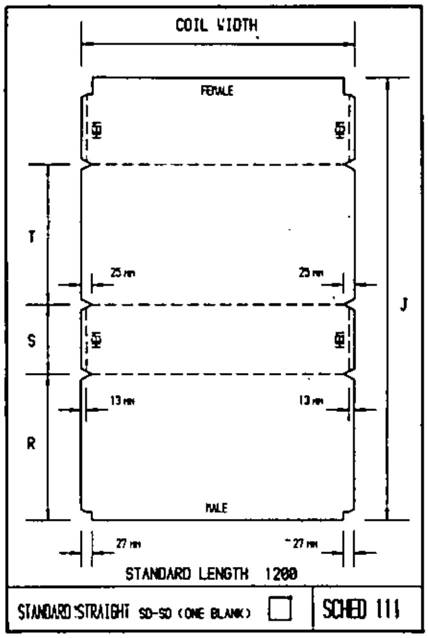


Figure 5: Dimensions required for shop floor manufacture of standard straights.

However, more sophisticated error-checking facilities are provided by two modules within COMPASS. The first of these is a clash-detection module, which will check the 3D model of the ductwork and structure for clashes. If a clash is detected, an error message is produced and the draughtsman can then amend his design. Also built in is a data-consistency checker. This enables the user to check that his design is consistent. For example, there are tests to confirm that all ductwork components have been positioned and orientated, and that there are matching joints between adjacent components. Again, an error message is produced for each error detected, and the draughtsman then makes the appropriate modifications.

Production of drawing.
When a consistent, clash-free design has been obtained, the draughtsman produces drawings of it. At this stage, they will typically consist of a plan view of the ductwork and the structure, with a number of elevations of selected areas. The draughtsman will not normally wish to show any lines on surfaces which are hidden from view, and COMPASS provides a facility for removing these 'hidden lines'.

The next stage is the dimensioning and annotation of the drawing. Working at a graphics terminal, the draughtsman specifies where he requires dimensions. Since proportional information is held explicitly in the 3D model built up during the design process, COMPASS can calculate these dimensions automatically from the design data. Therefore, the user does not need to perform any calculations by hand. Notes and other annotation are also added to the drawing at this stage. At the end of this process, a fully detailed, dimensioned, and annotated drawing is produced. It contains all the information which would appear on an equivalent manually produced drawing. When complete, this drawing is output on a high quality plotter.

The initial design task is now complete, and the drawing is sent off to the customer for approval. Any modifications requested may be easily incorporated into the design by changing the design model. Drawings of the modified design are then generated. At this stage an automatic labelling facility within COMPASS will be used to put item numbers, required for manufacture, on individual components. A number of isometric drawings may also be produced to aid visualisation when the ductwork is erected on site.

Production of manufacturing information.
As described earlier, a model of the complete design is held in a structured file on disc. Having produced the final drawing, the next stage is the generation of manufacturing and timing data, and any data required for requisition sheets or other documents. Under the manual approach, this scheduling function was carried out by hand, although use was made of a desk-top calculator. Hargreaves have written a number of algorithms for this calculator, and these are held on magnetic cards. Given the type of component and its dimensions, the algorithms produce data such as the number of blanks required, machine settings, time manufacture, and other manufacturing data.

To take full advantage of COMPASS, Hargreaves have rationalised their method for classification of components. They modified their scheduling algorithms accordingly, and these have been incorporated. In addition, Hargreaves have written new algorithms to determine component schedule numbers, and others to generate reports. Therefore, the whole scheduling function, which had to be carried out by hand, has been fully integrated. By use of a limited number of commands, the complete set of design data generated by the draughtsman is processed to produce, as line-printer output, all the documents required for manufacture.

There is flexibility in the system to allow Hargreaves to make further modifications to their algorithms to take account of changes in manufacturing technology. This technology is in advance of most competitors, and

Figure 6: COMPASS output of manufacturing data for standard straights.

SCHEDULE 111 - STANDARD STRAIGHT SD-SD

INPUT DATA							BLANKS			NOTCHES						ITEM NUMBERS
NO OFF	JOINTS F	B	GAUGE	LONG SIDE	SHORT SIDE	LENGTH	NO OFF	I	J	M	N	R	S	T	U	
9	SD	SD	0.6	300	300	1200	9	CO	ILx1241	-	-	308	300	300	-	105, 113, 112, 111, 110, 109, 108, 107, 106,
2	SD	SD	0.6	400	300	1200	2	CO	ILx1441	-	-	408	300	400	-	99, 100
6	SD	SD	0.6	600	450	1200	6	CO	ILx2141	-	-	608	450	600	-	50, 66, 61, 59, 54 53

INCENTIVE TIME SUMMARY FOR SCHEDULE 111 (17 PIECES)

ASSEMBLY = 2.04 ASSEMBLY ASSIST = 2.04 SPOT WELD CORNERS = 0.00 WELD CORNERS = 0.00

Hargreaves save money by being able to manufacture parts with complex geometry. COMPASS enables manufacturing instructions for these parts to be generated automatically.

Benefits

The COMPASS system offers a number of obvious benefits:-

1. Two stages in the design process, layout and detailing, have been combined into a single design function. The scheduling function now simply involves the output of data already held in the system. *Therefore, there is a significant* reduction in the delay between drawing approval and ductwork manufacture, and less possibility of errors.
2. The use of a standard component catalogue and a contract specification, containing design and manufacturing restrictions, provides increased standardisation. Special components, which need to be manufactured from drawings, are expensive to produce. COMPASS enables the number of specials to be kept to a minimum.
3. The full 3D modelling, and associated visualisation features which COMPASS provides, offer many advantages. In regions of limited space, where co-ordination is a major problem, the possibility of errors is greatly reduced. A design can be developed quickly and accurately.
4. Design changes can be costly, and the consistent modification of drawings may be time-consuming. COMPASS enables these design changes to be made quickly and simply. The modified drawings and manufacturing data may then be generated automatically.
5. COMPASS is popular with the draughtsmen who use it. It eliminates the task of drawing at a board, which can be tedious and time-consuming. *However, it retains the creative* aspects of their work, enabling their skills to be used more effectively.

The project has been a collaborative venture between Cadcentre and Hargreaves. This has enabled Cadcentre to complement its computing expertise with detailed knowledge of the ductwork industry, provided by Hargreaves. The result has been the production of a software system of direct relevance to industry. It is an integrated system, from design through to manufacture, but it has been developed to allow for future interfaces to other packages, such as stock control. Links to NC sheet metal cutting machines are another future possibility.

Sheet metalwork manufacture is a relatively low technology industry. However, the COMPASS development has shown how sophisticated CAD techniques, such as 3D modelling, can provide real benefits in such an application. This confirms the view that computer-aided engineering is relevant across a wide spectrum of the engineering industry.

Acknowledgements

The author wishes to thank Henry Hargreaves and Sons Ltd, Bury, and his colleagues at Cadcentre, for their help and cooperation in the production of this article.

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The Author, who is District Pharmaceutical Officer at the Hammersmith Special Health Authority, Hammersmith Hospital, London, first presented this article as a paper at the Institute's Symposium on the Distribution and Use of Gases in Medicine on the 31st March 1982 at Kensington Town Hall.

The Quality Control of Medical Gases

D J ANDERSON BPharm PhD MPS MIBiol

Introduction

Paragraph 29 of Hospital Technical Memorandum 22 states that the Regional Principal Pharmacist (Quality Control) has overall responsibility for the quality of piped medical gases used in hospitals. Each Health Authority is charged with the responsibility for nominating a Suitably Qualified Person, a pharmacist, who will be responsible for the identity, purity and quality of the gases at the terminal units. Pharmacists have an all-embracing responsibility for these aspects of medicinal products, into which category gases used in medicine fall.

The aim of the pharmacist should be to ensure that in a system of known integrity and good design (engineering responsibilities) the gases are safe for the patient and user.

In this paper, the various aspects are discussed with a view to examining the role of the pharmacist.

Identity

We should start by considering the gases likely to be piped. They are oxygen; nitrous oxide; air; Entonox

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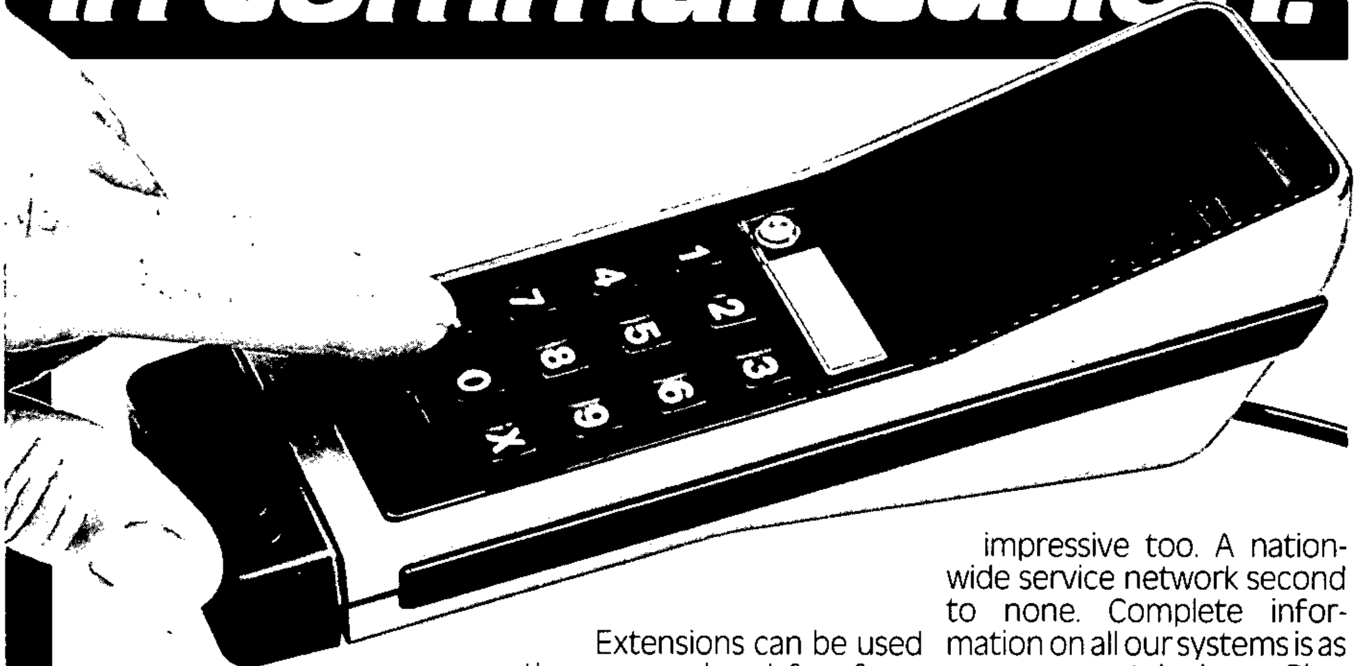

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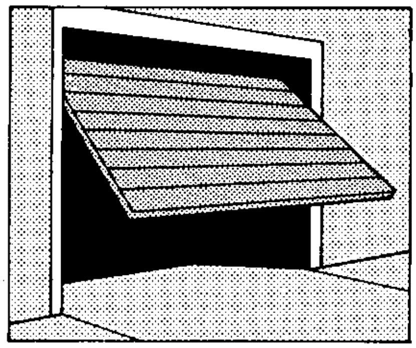

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and vacuum. Clearly, defining vacuum as a medical gas is almost as silly as making water a Prescription Only Medicine, although it *is* under certain circumstances! Nonetheless, certain tests are desirable: more than once pipes carrying vacuum have been confused with water pipes.

Identity of gases is relatively simple now using the TM3 gas differentiator. This utilises differences in thermal conductivity in the gases to identify the four gases mentioned. This is not without its problems, however. Carbon dioxide will give a similar respone to nitrous oxide, and could give rise to problems if it has been used as a shield gas for welding. Since most Suitably Qualified Persons (SQPs) will also employ Gastec detection tubes for carbon dioxide, the problem will at least be recognised.

Before this simple method was available, ingenuity was necessary to circumvent problems of using sophisticated laboratory instruments for identifying and quantifying gases. One such technique involved filling an empty 3 litre irrigation container with the gas to transport it back to the laboratory for analysis in an infra red spectrophotometer. For nitrous oxide, such a performance has been completely superseded by a TM40 nitrous oxide meter.

For oxygen, a Servomex oxygen analyser can be used. Clearly such a device can also be used to assess the oxygen content of air. Since Entonox is a mixture of equal parts of nitrous oxide and oxygen, both instruments are necessary.

For identity and the other parameters for gases, standards are necessary. In a straightforward example, oxygen, the usual pharmaceutical compendia and official monographs give us standards. The British Pharmacopoeia has largely been superseded by the less chauvinistic European Pharmacopoeia, but the United States Pharmacopoeia can also be used. Although different sources may offer different standards, they nonetheless give sound guidance, for use with commonsense and experience. The manufacturer, and even HTM 22, represent other sources of limits.

We cannot leave the subject of identity without mentioning vacuum for which identity is the primary parameter. We must be certain that the vacuum outlet does not offer a gas under positive pressure, nor anything else such as water. Parameters such as flow rate are not within the pharmacist's remit.

Contamination

If we have set standards that define the content of a gas as less than 100%, we clearly have to determine what the balance consists of. Inert gases such as nitrogen have little relevance to clinical medicine, but others must be strictly controlled. Water vapour may compromise equipment or pipework; gasoline or oil, nitric oxides and oxides of carbon will harm a patient in even small quantities. These will be examined both from the point of view of detection and from the source from which they come.

Water vapour may be derived from the source of the gas. A compressor without adequate safeguards and manufacturing faults represent two examples. Water vapour can be detected with an appropriate hygrometer by its dew point, but can also be detected and measured with the Gastec detector tube system. Gasoline and oil may be derived from compressors and ill-considered lubrication of equipment. Apart from the Gastec tube, there is a piece of equipment described in HTM 22 for the detection of oil. Nitric oxides may be by-products of the manufacture of nitrous oxide or other reactions between nitrogen and oxygen under appropriate conditions. Carbon monoxide may be derived from compressor exhausts. Both of these can be found with the Gastec tube.

Other contaminants may originate from the deliberate introduction of material with or without malicious intent. For example, air at high flow rates may be used to disturb and remove particulate contamination. Any failure to remove the purging gas will show up as contamination (unless the line is destined to carry compressed air, of course). In order to minimise oxidation of the pipe material, welding is being done more often with the pipes filled with an inert, shield gas. Nitrogen and carbon dioxide are common. I have already referred to the similarity of thermal conductivity of nitrous oxide and carbon dioxide, and the difficulty of separating them in the TM3 gas differentiator. Nitrogen is difficult to detect: it is inert and has few properties which endear it to the analyst. I will refer later to the application of commonsense to medical gas testing, and unexplained abnormalities during testing should make the SQP consider the possibility, especially as he should be aware of the nature of the work which has been carried out. He would also check for the oxides of nitrogen formed by the heat of welding in the presence of the nitrogen.

Particles

During an editorial of particulate contamination of injectable fluids in the early seventies, the Lancet observed that 'particulate matter is articulate patter for particles in articles'. Particulate matter represents a rather specialised form of contamination. Its origins are diverse. In old systems there may be high levels of contamination from corrosion of the inner surface of the pipe itself, and it may be impossible to purge this adequately. The material of the pipe itself (rather than the products of its oxidation may contaminate the inside of the pipework if the pipe is cut. Such material (and its oxidation products) usually constitute a high proportion of the contamination which is found. Such products can lie undisturbed for years and now be of danger under normal flow rates. Disturbance of the particles by the pipe being cut, bent, knocked or broken will constitute a great hazard. These particles can also be introduced at the time of engineering work. The testing of gases for particles is a topical issue, and I will describe the method used in the North West Thames Regional Health Authority. A Millipore filter of between 4 and 8 microns pore size is inserted into a holder, connected to a gas outlet, and the gas passed at line pressure for one minute. The filter is examined and can be retained as a reference sample. Results of this test can vary from horrific to perfectly acceptable. The test is a subjective one, but is very stringent. It employs flow rates in excess of those used in medicine and may disturb material which would not otherwise be moved by clinical use. Nonetheless, we would maintain that the test is perfectly acceptable in the absence of better standards. Other devices are under test.

The particulate contamination of old pipework can be so severe that purging with air will not clean it adequately. Some contractors are aware of this and may conduct their own tests in advance of the work for which they have been employed as a comparison when the work is complete. We must be aware of this and would be wise to undertake testing ourselves before the work is contemplated. This theme of cooperation between engineer and pharmacist outside the strict confines of HTM 22 is one to which I shall return.

The testing of medical gas pipework in newly built premises presents its own peculiar hazards. Brickdust, building materials and various liquids have been introduced into pipework accidentally. Even deliberate sabotage has been known. These circumstances present peculiar problems and must be approached with an open mind.

Testing Philosophy

Clearly testing must come after any high hazard work. Periodic in-use testing is of doubtful value. I have indicated already that where pipework is old, some initial testing may be desirable to establish the capabilities of the system prior to the work. The decision may be taken in the light of that evidence to continue as planned, embark on more extensive work, and even to do no work on that line at all.

One of the skills which the SQP must develop is the ability to liaise effectively. By discussion at an early stage, several advantages can be gained. First, as I have indicated, the present condition of the system will give a guide to the suitability of the work which is contemplated. Secondly, with a knowledge of engineering techniques, and discussion of these with the engineer, the pharmacist is better equipped to tailor his testing to the likely contaminants. Lastly, a discussion of logistics may minimise the number of outlets to be tested and so bring the system back into use more quickly.

Product News

New floor slat from Perstorp Form

Wet and hard floors are not only a nuisance — they can prove to be dangerous. A wet floor is slippery and a hard floor increases the likelihood of backache — one of the most common problems in industrial countries.

Perstorp's new economy floor slat is designed for working areas where people stand for long periods. Each slat, measuring 600 x 600mm costs at list price £2.85 each, which works out at approx £0.70 sq/ft. Discounts will apply subject to quantity.

The slats can be easily linked together and cut to size to fit awkward corners. They are manufactured in brown LD polyethylene to provide the right cushioning effect and are available ex stock.

Further information can be obtained from Perstorp Form, 97 High Street, Marlow, Bucks SL7 1AB. Telephone (06284) 72026.

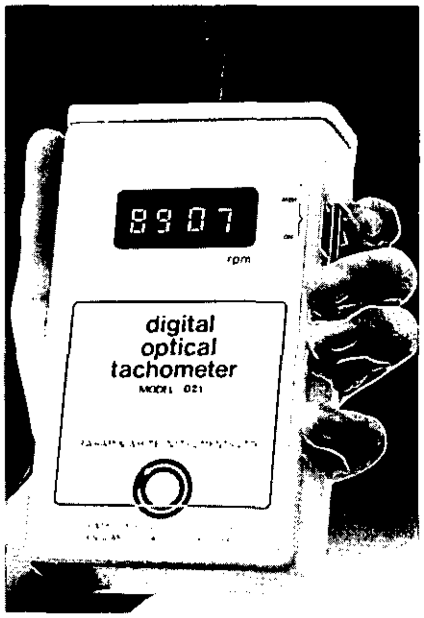
New Hand Tachometer

The new D21 is a portable optical digital tachometer using a 9999 L.E.D. display.

The instrument may be operated up to 1,000mm away from a rotating shaft by projecting a beam of light onto the rotating surface. Reflected light pulses from a strip of suitable tape are accepted, by the single lens reflex system, converted, and displayed as a numerical reading. The speed range is up to 20,000 r.p.m. with an accuracy to ± 1 r.p.m. After the measurement a continuous memory automatically holds the last reading. The list price of the D21 complete with batteries and reflective tape is £103.

For further information contact J. T. Beck, Graham and White Instruments Ltd, 135 Hatfield Road, St. Albans, Herts AL1 4LZ. Tel: St. Albans (0727) 59373.

Graham and White Instruments Ltd's new hand tachometer.



Safelink Socket Outlet

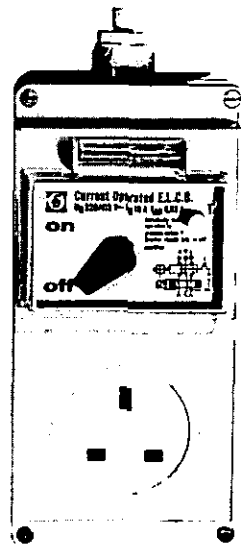
To protect any user of electrical power working in a potentially hazardous or damp situation Tripower have introduced a new residual current device protected socket outlet designed to reduce the risk of a human being receiving a fatal electric shock.

The Safe-Link is a high sensitivity unit rated at 30mA and the manufactureres claim that it will operate within 30msecs of a fault being detected. Tripower see applications for their new Safelink socket outlet in laboratories, workshops, garages, nurseries and gardens where portable tools and equipment are likely to be used.

Measuring 177 x 90 x 60mm the Safe-Link socket incorporates a protected switch toggle and test button. Internal fixing holes are fitted for surface mounting and facilities for top or bottom single 20mm threaded entry are provided.

Further information on the New Safe-Link protected socket outlet — Which costs £27.40 — is available, on request, from Tripower Limited, Everton, Sandy, Bedfordshire. Tel: (0767) 50011.

Tripower's safelink socket outlet.



Hot Water Boiler Surveillance Units

Hot water boiler surveillance modules designed to provide supervisors of modern heating plant with sufficient information to enable them to monitor boiler performance, plan energy management programmes, and to operate cost effective maintenance schedules, have been introduced by Clyde-Combustions.

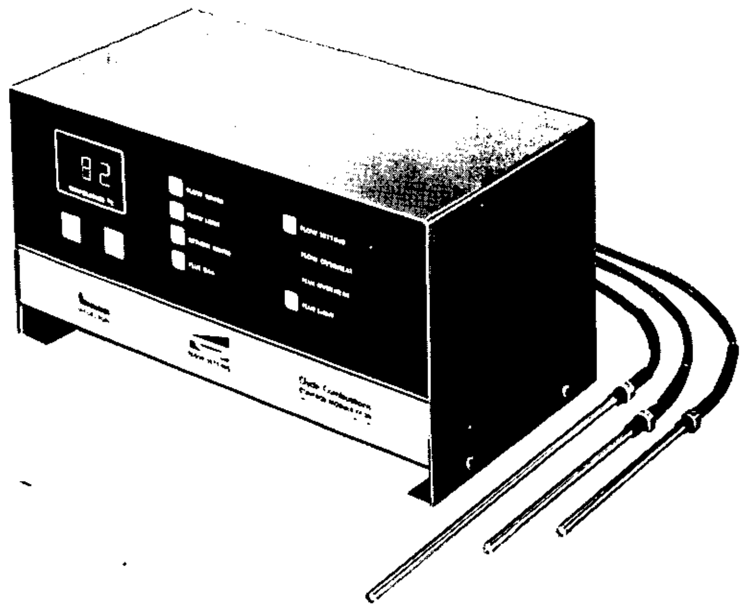
Signals from high-accuracy resistance sensors, and modern solid state technology, are employed to control burner operation, and give clear digital displays of operating temperatures on a functional easy-to-read facia.

Two models are offered — CC10 and CC20. Depending upon the model choice, the user can measure, monitor, and obtain visual temperature displays of flow water, return water, and flue gases. Illumination of facia LED's indicate the operational mode of the control, and give visual warning of abnormal conditions. Terminals are also provided for the connection of remote visual or audible warning devices in the control system.

Manufactured in the United Kingdom, the modules are housed in rugged steel cases finished in blue stoved enamel and are fitted with easy to clean PVC facias.

CC10 and CC20 control modules are supplied with Clyde-Combustions boilers, combination units, and/or burners. CC20 is supplied as standard with the 451 range of boilers. CC10 is fitted as standard to all 351 boilers and 351T combination units. CC20 is optionally available for both 351 and 351T ranges.

Further details are available from David Hopkins, Clyde-Combustions Ltd, Cox Lane, Chessington, Surrey KT9 1SL. Tel: 01-397 5363.



Clyde-Combustions Ltd's Boiler Surveillance Unit.

Computer Program to measure the sun

Colt Solar Control, in collaboration with W.S. Atkins & Partners, has produced a new computer program called Sunfax. intended to assist Specifiers at a very early design stage the program will provide facts about the relationship of any building surface to the sun in any latitude.

For each hour of the day and each month of the year the program will produce angles of incidence, vertical shadow angles and total intensity. Intensity is broken down to show proportionate direct radiation, diffuse radiation and ground reflectance.

A wide range of glass treatments can be catered for enabling total solar heat gains to be compared for various conditions. Cooling loads attributable to solar gains through glazing combinations may also be compared.

Only with full knowledge and understanding of the effects of solar radiation on a particular building can the best means of external shading be selected. Colt Solar Control offers a free technical advisory service.

Further details from R. F. Wallace, Managing Director, Colt Solar Control Ltd, Havant, Hants PO9 2LY. Tel: (0705) 451111.

Hospital generator sets use Ni-Cad Power

As power lines collapsed across Cornwall in last winter's blizzards, hospital standby generator sets were powered into action by nickel cadmium batteries at both the Truro and Falmouth and Budock hospitals.

These hospitals had relied on nickel cadmium batteries supplied by Chloride Alcad Limited of Redditch since the early 60's so that when they came up for replacement last autumn nickel cadmium batteries by Alcad were again specified by the Hospital Engineer, Brian Cleave.

Two sets of 24 volt high performance batteries were supplied for the twin generator sets at the Treliske Hospital in Truro and one 24 volt battery for the generator at the Falmouth and Budock Hospital.

The blizzards brought these new nickel cadmium batteries their first call to duty and, as the mains supply faltered they tripped the generator sets into action. With the weather worsening, it was decided to keep the generators running until a normal mains supply could be relied upon.

Brian Cleave emphasised both their reliability and their minimum maintenance needs. "They give an instant high rate discharge to start the diesels," he said, "and have excellent charge acceptance characteristics. With only minimum maintenance they do last for many years as proved by our previous alkaline batteries."

Chloride Alcad claim that continuous research has produced significant improvements in their latest, and compact, high rate discharge batteries for engine starting — the UHP range. This employs a new plate design which increases plate exposure to the electrolyte combining great mechanical strength with a very low electrical resistance. It gives an estimated 25% increase in output at high rate discharge and has generous reserves of electrolyte to reduce topping up needs.

Further information from Roland C. Harrison, Chloride Alcad Limited, Union Street, Redditch, Worcestershire B98 7BW. Tel: Redditch (0527) 62351.

Classified Advertisements

APPOINTMENTS AND SITUATIONS VACANT

To place a classified or display advertisement in this journal contact:

Kate Oriel

Hospital Engineering,
48 Southwark Street,
London SE1 1UN.

Tel: 01—403 6166

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Job description and application form from the District Works Officer, Riversvale, Litchdon Street, Barnstaple. Tel: (0271) 75851 Ext 53.

Closing date: 31 October, 1982.

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