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No. 19

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Incorporating The Hospital Engineer

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August/September 1976

The Journal of The Institute of Hospital Engineering

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The UK National Health Service before and after reorganisation

by J. WINNING

The United Kingdom health service is not a homogenous structure; it is an amalgam of professions and of skilled and unskilled workers grouped in various hierarchical and professional relationships. Crossover points, i.e. management posts at upper levels of the structures, exist for co-ordination and administrative convenience. The Secretary of State is at the top of a wide-based pyramid management structure, having a hierarchical relationship with the civil servants beneath. They, in their turn, have a monitoring organisational relationship with the regional health authority staff. Richard Crossman remarked that the power of the Minister must be used with discretion to have the maximum impact. It can, therefore, be assumed that the Minister will only interfere to determine major policy, to re-allocate or bid for resources, or to lead inquiries about abuse of powers or changes to the service. It is at Cabinet level that the Secretary of State will bid for resources, an important function in these times of economic difficulty.

Changes

It is at regional, area and local-authority level that changes have taken place, although it must be recognised that internal reorganisation has taken place within the Department of Health & Social Security. As an administrative organisation, it can be broadly said to be unchanged.

Mr. Winning is with the Wessex Regional Health Authority, Highcroft, Romsey Road, Winchester, England

The past

At the time when interviews were taking place for works posts I was impressed by the comment of an assessor. He stated he would like to give the next appointment to the candidate who did not use 'challenge' in his submission. What then was wrong with the former service? To establish this, I have rather crudely drawn together an approximation of architect/engineer activities, a works professional being an unknown at that time.

The regional boards were mainly concerned at that time with planning activities and policies. The regional architect and regional engineer have therefore had a major role to play in managing specialist divisions and contributing to the development of the capital programmes.

Engineering and building development did not form a major part of the task of hospital management committees. Minor works were controlled largely by the boards in the form of a programme or by the hospital management committees themselves from their revenue funds. In many cases maintenance money was inadequate and often wrongly used for upgrading and similar activities.

Regional hospital boards were governed by committee structure, served by the various board's officers. In the main, the secretary, treasurer and the senior administrative medical officer provided spokesmen for the various committees, with the specialist officers, such as the engineer, architect or establishment officer providing advice for individual items. The management of departments within the board was the responsibility of chief officers, who had developed their own form of structure.

In certain instances, the regional engineer and regional architect had adapted part of their department organisation to conform with the planning areas within the secretary's department.

The liaison between departments has been effected at chief officer meetings. These meetings had not been totally successful. In certain boards the timetable of meetings was very irregular and the detailed content of the agenda was not of high quality. It was more usual to avoid major management themes and difficulties, rather than to investigate them.

The regional engineer and regional architect have a closer professional relationship than with either the administrator,' s.a.m.o. or the treasurer. The role of engineer and architect alternated between subordinate and leader, according to the nature of the contract. For instance, the architect would lead in a major development, whereas in a laundry project, or boiler house, the engineer would assume this role.

In recent years the quantity surveyor had emerged in a major role, chiefly concerned with cost planning. The question of the use of bills of quantities had also had a disruptive influence which has militated against harmony between the professions.

Table 1

	Credits	Debits
1	Members had a role which gave a feeling of involvement and leadership	Detail was discussed, and policy was not effectively developed
2	Committee for works matters	Possible delay in decision taking and limit to officers powers to manage
3	Planning initiated and carried through by a sponsor, e.g. regional engineer or group engineer	Possibly did not co-ordinate projects with others, or perhaps did not provide what the client wanted
4	Quick reaction to local needs	Slow response to regional and national policy
5	A growth situation in which major schemes were possible to plan and fulfil	Possibly oversized hospitals. Lack of effective link with local authorities (community services)
6	Informal understanding between regional and hospital staff	Possibly lack of detail planning and site supervision for delegated schemes owing to staff limitations and adequate facilities
7	A merging of some smaller H.M.C's.	Mixed results: as many shotgun marriages as true love affairs

In the early 1960s the regional architect was concerned with the programming of capital projects, in which he was assisted in a minor capacity by the secretary. The role, however, was reversed with the secretary assuming the planning function and appointing area secretaries. Little emphasis had been placed on leadership or accountability when considering individual projects, many of which have taken an unusually long time to bring to completion from the early planning stages.

The effectiveness of regional engineers or regional architects had been judged by their ability to meet building programmes, i.e. performance on site.

To assess what was good and bad in the past, an attempt has been made to draw up a balance of some credits and debits (Table 1).

The present

The functions and the management structures of the regional and the area health authorities were described in detail in the 'grey book' *Management arrangements for the reorganised national health service* (1972). However, its interpretation differs from area to area, and time moving on since it was published has caused necessary revisions. It is proposed to deal with salient management features that have originated or changed since reorganisation.

The authorities

The authorities have fewer members, some of whom must be clearly identified as representing local authorities. Staff members, other than medical and nursing, will be represented through directives of the Secretary of State anxious to achieve democracy in the decisionmaking processes of the authorities.

The members have had difficulty in settling into a role of guardians of policy rather than detail. Senior authority officers have not always made their task easier by the way business has been structured. Policies which take months to develop and negotiate cannot be easily absorbed by casual reading before a meeting.

Committees have been disbanded and meetings of officers now take their place. Members do not have the same feeling of close involvement formerly generated by committee membership.

The perspective of the regional health authority is slowly emerging, launched by policy paper which require detailed analysis by members to comprehend. It involves a different type of commitment. Members need to read widely, question astutely in order to keep officers of the authorities on their metal.

Senior officers

There is now a commitment to consensus management. A question which has been asked points at the main concern about this form of joint involvement.

'Does consensus management dull the edge of efficiency?' A general answer is that 'it depends on the participants'. To assess this question satisfactorily, it is necessary to refer briefly to decision making theory.

(a) Power

Power is not equally spread. This can be identified by professions, the medical officers having a very strong power base in relation to medical matters which overlaps into related fields such as nursing care, and financial control. The administrator sits at the crossroads as co-ordinator; he has access to information and the ability to handle management decisionmaking with delicacy. The works officer has a keen interest in common-services matters and items related to organisational-management problems. The treasurer has a leading role as economist and financial adviser, and the nurse a concern for patient care and support services for nurses. Thus lead speakers will emerge in debates, and their opinions will have more weight than others.

Power can also be vested in chairmanship if a man of forceful personality is selected. Some management groups rotate chairmanship

(b) Perspectives on the organisation

(i) For consensus management to work ideally, members should share common objectives. It is, however, possible to agree on major policies, but to have differences in objectives, for the various professions have different interpretations of what is best for the service, e.g. a higher level of care for the patient might involve increased staffing, better meals, occupational therapy, and so on; all of which may be desirable but possibly only one improvement is possible within a limited budget.

It could, therefore, be that to achieve progress bold steps for improvement are not taken, but a compromise incremental decision-making process adopted.

(ii) It is also possible to view the management group as an arena of conflict where decision makers are partisan, do not share objectives but seek to achieve what is best for their own specialty or profession. In the works sense, this may be represented by a medical officer using pressure to invest the block minor allocation of capital for medical equipment, to the detriment of plant replacement and building upgrading. It is unlikely that the extreme situation will apply, more likely that the man more capable of presenting a case and having an equal power base will achieve equity at least, and possibly a little more.

(c) Decision-making continuing process

One decision calls for several other decisions to achieve the original aim. There tends to be a pyramid of decisions, with the most general decision at the top followed by an expanding base of more particular decisions, each concerned with a small area of activity.

In an organisation, no one person on a group may be responsible for carrying through each and every stage. Delegation is likely and, as a result, a number of influences become important.

In general, it is fair to say that the new form of consensus management has not yet developed a fixed style or character. There is a need to consult, to monitor, to harvest plans and to heed the directives about economy, devolution and so on. These do not make for ideal conditions. It is highly likely that each management team will be influenced by powerful members, professional in their application and enthusiasm.

A final word on the management games generated and further developed by reorganisation:

Confetti management: A tendency for senior members to shower memoranda on lower managers. There are a number of reasons for this. They must be seen as responsible leaders. A tendency to pass the buck in the present era of identifying 'responsible' officers. It has the overall effect of creating a poor response to all requests and instructions, so that important issues do not receive the concern they deserve. (Hazard notices are an example.)

Musical chairs: A need to be seen. A tendency to overman site meetings, project teams and so on. Why are the majority of meetings now taking place?

Consultation: A process which may mean something or nothing. Usually it is mock consultation with the moving hand having written moving on. People are happier to speak than to listen. Consultation is locked in a straight jacket of time constraints and preconceived ideas.

Delegation: In the extreme case means 'opting out', at the other end of the scale lies the interpretation of passing on but retaining control. It is a difficult process for 'old dogs' forced to learn new tricks in a reorganised management structure.

NHS politics: Means hanky panky, an umbrella term for skulduggery and gamemanship. Adds colour to life; we all indulge in it to a greater or lesser extent.

Word games and puzzles: The art of coining or using the current new word or term and leaving the listener or reader to guess what is meant. Much beloved by planners and public speakers. Probably expressed most noticeably in committee papers.

These are just a few examples, there are others if you care to detect and observe the management jungle signs.

(i) The reorganisation has not yet had adequate time to work.

(ii) For the first time we are looking at the way we are planning to spend our money, e.g. district general hospitals in comparison to primary-care services and indeed attempting to jointly plan our activities.

(iii) The current management sickness has some self-healing symptoms. People are questioning what they are doing. They are seeking job satisfaction and looking at present management systems.

(iv) From the process of reorganisation will finally emerge an improved service for the patient. The more effective use of scarce resources. A service responsive to public opinion, and one which embraces most aspects of patient care.

Reorganisation - background information

Green Paper 1, 1968

Proposed national planning in the face of technological changes, manpower shortages and the economic situation. It suggested the service should be unified under 40 to 50 area health boards instead of the 700 existing separate authorities.

Redcliffe Maud report

Produced in June 1970, argued for health services to be placed under the district councils of their local authorities. Thought to be some unease about NHS being not accountable to the local electorate. Argued against area boards proposed in the Green Paper. Thought all family services should be unified under local authority.

Guillebaud Committee 1956

Was against transfer to local government. It did not believe that reform of the local government structure would go far enough. It did propose sweeping changes in the administration of the Health Service.

Green Paper 2, 1970

(i) Proposed the NHS be independent of local authorities.

(ii) Proposed that environmental health and personal social service continue with local authorities.

(iii) Proposed that new health boundaries to match local authorities as well as professional bodies and members of the public be represented.

Aims

(i) United health services. Integrate at local level.

(ii) Establishment of close links between NHS, public health and social services of local authorities.

(iii) Maximum responsibility on area health authorities with strong local and professional participation.

(iv) To provide effective control over the money to be spent on the service and to ensure maximum value.

Four aims

Unification, co-ordination, local participation and effective central control.

The Consultative Document 1971

1970 change of Government from Labour to Conservative: Ministers change—Richard Crossman to Sir Keith Joseph.

(i) Hospitals, health centres and community nursing services under NHS Department of Education to retain school health?
Occupational health to remain with ~~Depart-~~

(ii) Regional health authorities were reintroduced between AHA and the DHSS.

(iii) Efficient management to be the keynote. People with management experience to be nominated to authorities.
Community health councils would be set up to represent local interests (To have no executive powers.)

(iv) Social services would remain with the Local Authorities.

(v) Administration of g.p. services would be placed under committees like the executive councils, with direct links with the DHSS and separate financial system from AHAs

(vi) Teaching would be separately financed from the regions and there would be special committees to deal with planning.

Correspondence

Dear Sir,

I read the May International Federation Issue with considerable interest, especially the excellent report of the Paris Congress by Mr. J.E. Burton.

This article confirms the impression I gained when, as the only architect in the NHS, I attended the Athens Congress in 1974. At that Congress I heard some 40 interesting papers delivered by architects and planners (as distinct from engineers). Unquestionably there were many papers on engineering too.

My purpose in writing to you is to air the point that an engineer qualification, on the continent, is frequently the qualification of the architect. The UK Institute of Hospital Engineering and the DHSS itself are in danger of seeming isolationist in clinging too slavishly to the engineer description as an argument for excluding full participation by their architect and quantity-surveying colleagues—not to mention the new 'animal' in the NHS—the works officer—Regional area and district— who have been appointed from all the professional disciplines.

Personally, I believe that all the disciplines have so much to learn from one another in order that works departments really will function as unified entities, the IHE has a valuable contribution to make, and might even consider changing their title to the Institute of Hospital Engineering and Works. In that way we could begin to relate more closely to our continental colleagues.

Yours faithfully,
David W. Hanson

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28th June 1976

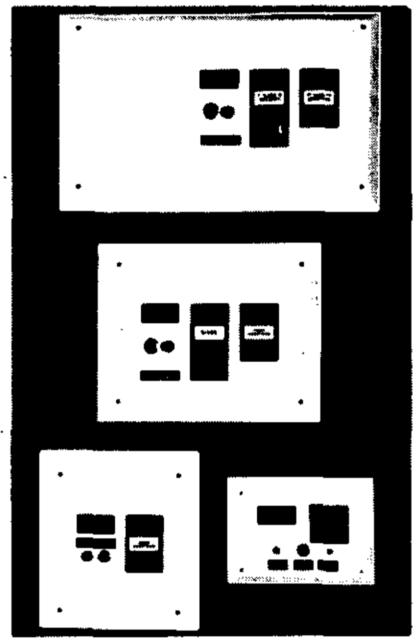
Medi-systems

HE News

A medical-gas alarm system and a range of vacuum pumps for medical applications have been launched by Applied Pneumatics Ltd of Hoddesdon, Herts., England.

The alarms comprise the Medialarms systems and are the result of four years development. The range conforms to the Department of Health recommendation HTM22 and the CEE regulations. It features a plug-in system whereby the front panel, which also incorporates the housing of the socket components, can be removed completely from the terminal block in the carcass box which is used to connect to the main hospital wiring. To make the system more flexible, each service has its own plug-in circuit board containing all alarm relays etc. applicable to that particular function. The alarms are designed for wall or flush mounting utilising the appropriate enclosure. Both flashing and steady lights are available.

The range of medical vacuum plants name Medivac, this range also complies with Department of Health recommendation HTM22 and the CEE regulations.



Front panels for Mechalarm systems

The range comes in two configurations; the complete vessel mounted package, up to 26631 l/min, incorporates twin vacuum pumps, automated control panel, bacteria filters and secretion traps. Alternatively, a kit with sizes up to 14 760 l/min is available. This range has an independent vertical vessel, twin vacuum pumps, automatic control panel and wall or free standing bacteria panel with secretion trap. The vacuum pumps are of rotary design and are powered by a flange-mounted direct-coupled motor.

The company will also be marketing a new range of air compressors under the name Mediair in the next few months.

A nice quiet hotel

The London Tara Hotel overlooks a busy junction of London's underground-railway system and, as a consequence, until recently, suffered from a severe noise problem. Ordinary double glazing proved ineffective and the windows could not be left closed in the summer as the atmosphere became oppressive.

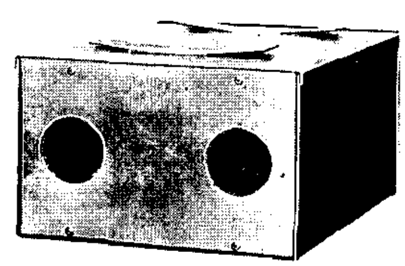
In a final attempt to solve the problem the hotel set up a working party, which identified three main problems:

- How to improve the sound insulation in each affected room? The acceptable intrusive noise level was specified to be 38dBA and the ambient noise level 31dBA.
- How to ventilate each room from the outside and still insulate it from train noise?
- How to aircondition each room without ducting or trunking.

The first stage in reducing the noise level was to seal the existing outer windows and lock the inner windows, thus reducing the intrusion sound level from 58 to 43dBA. To reduce this by a further 5dBA, the thickness of the outer glass was doubled to 12mm.

Airconditioning was the next problem to be tackled, and, having rejected ducted-air schemes, the working party settled for Siemens's Sivent airconditioning/heating unit. The Sivent has a typical noise level of 31dBA, they are water cooled and can operate either in a heating or airconditioning mode; the change-over from one mode to the other being automatic. A heat pump is also built into the unit, allowing surplus heat to be transferred back to the hotel's hot-water system. Installation involves simply removing existing radiators, altering the pipework to suit the Sivent and connecting it to the main electricity supply.

The final problem was how to supply air to the Sivents without letting the noise back in. Greenwood Airvac Ventilation Ltd. had just completed tests on a noise-attenuating acoustic ventilator unit originally developed for use with domestic gas appliances. The ventilator is a sound-proofed 260 x 140 x 220mm metal box comprising two perforated tubes encased in mineral wool of a specific density. It is fitted in the wall adjacent to the Sivent unit.



The Airvac noise-attenuating air brick

The hotel management estimate that the total cost of all the modifications was £400 000, many of the hotel's 850 rooms being affected although only 5% of these rooms were out of service at any one time. A relatively cheap and elegant solution to a problem that could otherwise have cost the London Tara much more in loss of custom.

Problems with low-temperature-steam and formaldehyde sterilisers

by N. CRIPPS, C.E.A. DEVERILL AND G.A.J. AYLIFFE

The use of low-temperature steam and formaldehyde for sterilisation has been shown to have certain advantages but sterilisers using this system cannot be yet installed with any guarantee of reliability. This paper presents results of some operational and bacteriological tests suggests steps that can be taken to ensure proper operation.

Introduction

Sterilisation with low-temperature steam (65–75°C) and formaldehyde, or disinfection without formaldehyde, has many advantages over other methods for the treatment of heat-labile equipment in hospitals. Although it has been shown that the method can be satisfactory and reliable, [1-4] it has not received the attention to working details that is required and it is used rather less than expected. At the present time, no low-temperature-steam/formaldehyde sterilisers are in routine use in the West Midlands. Operational and bacteriological tests on three sterilisers, of varying size from more than one manufacturer, have shown a number of deficiencies. In 54 cycles investigated on these machines, 26 showed at least one operational fault, which was often associated with failed spore tests. In this paper, we describe some of the problems and suggest some possible modifications.

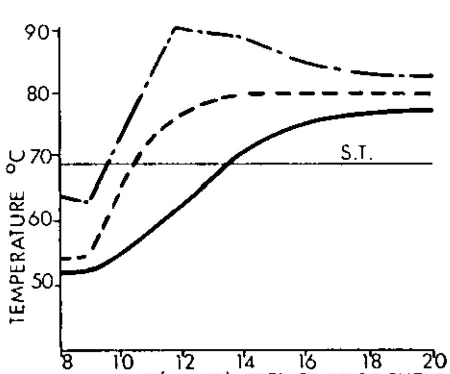


Fig. 1 Thermocouple recordings when the jacket valve failed to close
—— load temperature - - - steriliser chart recorder temperature —.— chamber-wall temperature S.T. = selected temperature

Temperature control

Good temperature control is essential to avoid damaging expensive heat-sensitive equipment. The load temperature, measured with a thermocouple in a cardiac catheter, was on one occasion 15°C higher than the selected sterilising temperature (72°C). This raised temperature remained throughout the constant-temperature part of the cycle and appeared to be due to steam-control valves to the chamber and/or jacket failing to close. Fig. 1 shows thermocouple recordings when the jacket valve failed to close and the load eventually overheated. Fig. 2 shows the thermocouple recordings when the chamber valve remained open too long and the temperature of the load rose rapidly above the sterilising temperature. In a normal cycle, the temperature of the load should not rise above the selected sterilising temperature. A high-temperature cutout, operating at not more than 5°C above that of the sterilising temperature, should be fitted to all machines.

Dual-purpose machines

Although dual-purpose machines, i.e. combined porous-load and low-temperature-steam/formaldehyde sterilisers, are not recommended by the Department of Health and Social Security, a number of expensive dual-cycle machines have already been installed. Many tests on one such machine have shown that a reproducible starting temperature of jacket and chamber is essential for reproducibility of the cycle. Therefore, a jacket-temperature control mechanism and a jacket-temperature indicator is required for both single- and dual-cycle machines. It should be possible, when a temperature-control

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mechanism is fitted to a dual-purpose machine, to obtain a satisfactory cycle if the jacket temperature is stabilised overnight, and the low-temperature cycle is used the following morning before any porous-load cycle. However, it must be recognised there are special problems of maintenance and routine operation of dual-purpose machines.

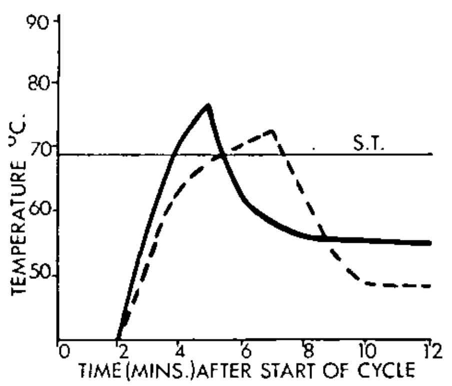

Fig. 2 Thermocouple recordings when the chamber valve remained open too long
—— load temperature - - - steriliser chart-recorder temperature S.T. = selected temperature

Problems

The recorder charts often do not give a true indication of the temperature of the load. The thermocouple in the chamber drain usually records a temperature below that of the load (see Fig. 3).

Excessive condensation on the load and on the inner surface of the chamber was found in one machine. This prevents adequate penetration by formaldehyde gas, with consequent failure of sterilisation. Condensation was probably due to one or more of the following factors: poor steam quality, variable jacket temperature, or the small pressure differential between the vacuum pump and the chamber during initial vacuum and/steam formaldehyde pulsing. This differential is further reduced by lifts in the small-bore pipework. It is also important that all drain pipes and fittings should be routine-tested for air tightness.

Failure to adequately remove condensate or a failure in the aeration process may leave excessive formaldehyde in the chamber. For the safety of the operator, a vacuum chart recorder must be fitted to detect aeration failure. Too much formaldehyde in the chamber at the end of the cycle can usually be recognised by its smell, but can be confirmed by a simple chemical test. Manufacturers vary in their recommendations on the amount of formaldehyde used during a cycle, e.g. the amount of formaldehyde recommended for two 0·6 m^3

machines was 250 ml and 320 ml., respectively, and a similar amount was also recommended for a 0·1 m^3 machine. A much smaller amount of formaldehyde (i.e. 50 ml) appears to be as effective[4] and will lessen the possibility of excess residual formaldehyde in the chamber and toxic residues on the load at the end of the cycle; the formaldehyde pipe will also be blocked with formaldehyde polymers less frequently. A mechanism for flushing the pipe through with water at the end of the day is in use in Bristol (recommended by M. I. Lees, District Engineer, Bristol District Hospitals).

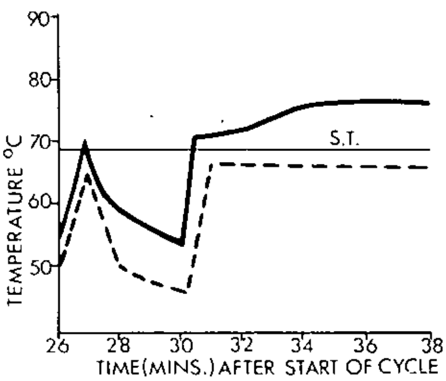

Fig. 3 The thermocouple in the drain chamber usually records a temperature below that of the load
—— load temperature - - - steriliser chart-recorder S.T. temperature = selected temperature

Testing

Until machines are more reliable, a test piece containing a spore strip[2, 5] should be included in every load. Either of these test pieces should be adequate, but further tests are required to determine the most suitable. *'Oxoid' B.stearothermophilus* spore strips were used, although they were inadequately standardised for comparative studies. When commissioning the autoclave, spore strips should be placed in different parts of the chamber, as well as in test pieces. In a satisfactory cycle, all spores within the chamber should be killed; surviving spores were sometimes found in the lower part of the chamber, but not in the upper part of the chamber and uncommonly in the load (Table 1). These poor initial results were presumably due to condensation moistening the strips and preventing penetration of the formaldehyde gas. A false negative result may also be obtained if the spore strip is moistened with a formaldehyde solution during the cycle; germination of surviving spores may be prevented by small amounts of formaldehyde in the culture medium with a corresponding negative result. These problems may be overcome, to some extent, by drying the spore suspension on an aluminium strip, but it is more important to prevent condensation. Occasionally, spore strips showed growth at 10–12 days after treatment in the steriliser. Routine incubation periods of 4–5 days should not be relied on, and, in preliminary tests, spores should be incubated for 14 days.

Table 1 Survival of *B. Stearothermophilus* spores after exposure to low-temperature-steam/formaldehyde sterilising cycles

Site of spore strip	Number showing growth of spores
Test helix	2/54
Packs	1/41
Airways	2/20
Base of chamber	10/60
Above drain	17/40
Other sites in chamber	0/65

Conclusion

Low-temperature-steam/formaldehyde sterilisers cannot yet be installed by manufacturers with any guarantee that they are satisfactory for immediate use, and, if machines are to remain in routine use, continued attention by bacteriologists and engineers is required. We hope to make further studies on these machines when modified as suggested in this paper. It is advisable to consult the Department of Health and Social Security before buying any machine, although it is expected that a British Standard will soon be available. The requirements for low-temperature steam in a hospital should be carefully assessed. Formaldehyde may not be necessary for most of the cycles where disinfection only is required. Machines should preferably be installed in a central area with adequate ventilation and where effective bacteriological and engineering surveillance is possible. The microbiologist and engineer should always collaborate in commissioning tests.

We wish to thank the engineers of the hospitals concerned for their co-operation.

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The development of hospital engineering in India

by J.C. Mehta

Introduction

The Postgraduate Institute of Medical Education & Research P.G.I. is an institute of national importance under Act of Parliament. Originally conceived in 1960, the faculty came into existence in 1962 and the first patient was admitted on 23 June 1962 - coinciding with the founding of Institute of Hospital Engineering in India. It now has 148 faculty members, 100 registrars, tutors and clinical instructors, 300 trainees on its staff in 15 postgraduate departments, including specialist departments such as cardiothoracic surgery, plastic surgery, gestroenterology, endocrinology, otorhino-laryngology, radiotherapy, microbiology, pathology etc.

Attached to the PGI is the Nehru Hospital (Fig 1), named after Jawahar Lal Nehru, it has 1000 beds, although 270 beds are not used at present owing to financial stringency. It admits patients not only from North India but from all over the country with an annual out-patient department registration of 375 047 - admitting of 20 030 patients. Full 'public-participation' is ensured through a Citizens Advisory Committee, a Ladies, Hospital Welfare Committee etc. With the re-orientation of country's health services, extension services are being offered by 'adopting' village hospitals which are visited by specialists and trainess from the PGI.

Plan of the campus

PGI campus, along with its hospital, is located along Patiali Rao in the instructional belt of the city. The hospital started as a modest 250-bed district-level hospital and has evolved to a 1000-bed teaching-hospital complex.

The hospital consists of five ward-blocks, each having five floors, besides the recently constructed 3-storey cobalt-therapy block. All out-patients departments are located in the lower two floors and the service block, comprising radiology, blood-bank, laboratories and 16 operating theatres, links the entire system. The main orientation has been kept north-west/south-east. There is considerable inbuilt 'flexibility', established by the additions and alterations of the last 2 to 3 years.

Facing the hospital, on the left-hand side of the entrance, is the Institute (Fig. 2). At present, the Institute consists of two 6-storey laboratory cumteaching blocks. The third such block, which should house an undergraduate college, is yet to be built. All these blocks have been oriented north-south. The northern bays accommodate the laboratories and the southern bays accommodate the offices and lecture rooms. Each floor accommodates an independent department with its own lecture hall.

The other two functional structures are the 1000-

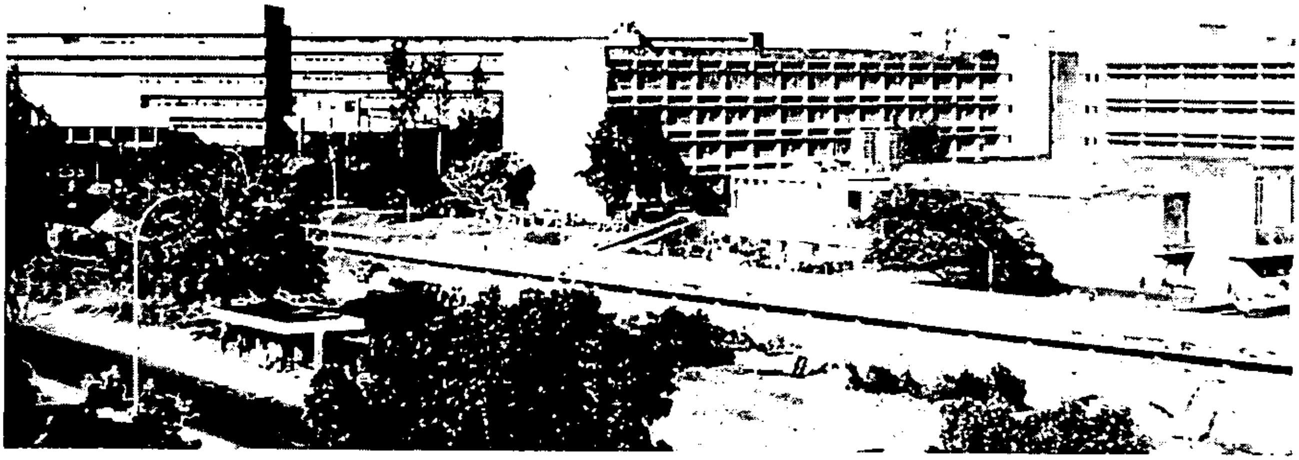


Fig. 1 Nehru Hospital

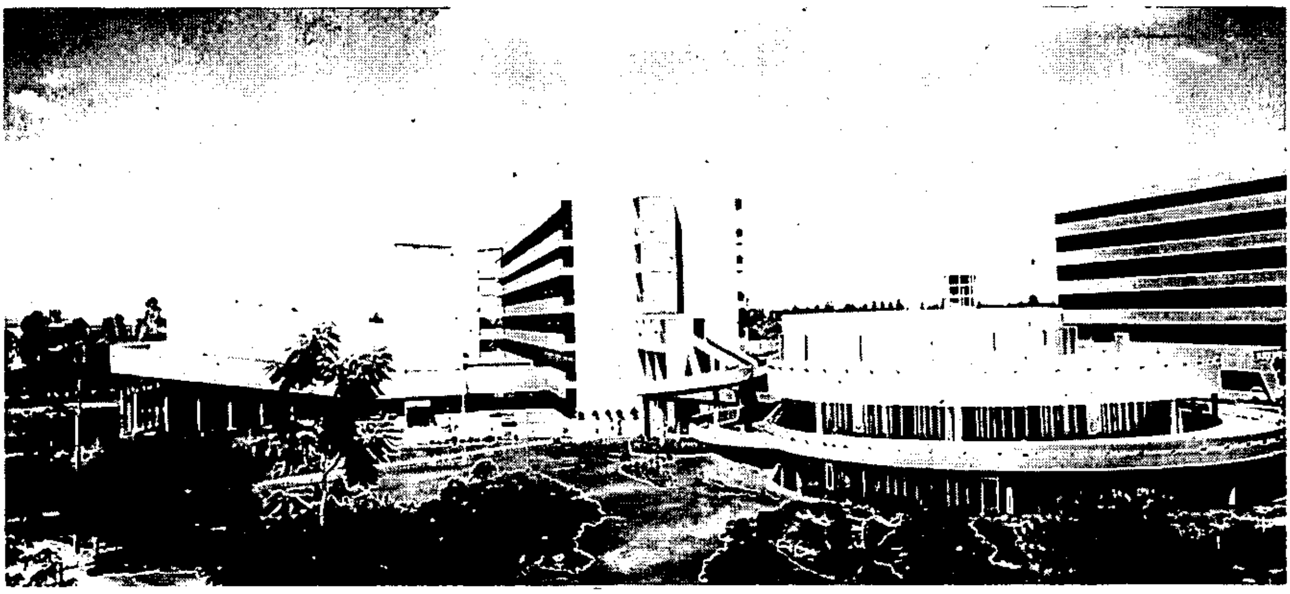


Fig. 2 **Research Blocks A and B of the Institute with the central cafeteria between**

seat assembly hall, which, it is proposed, will be fitted with a multilanguage simultaneous - translation system, and a central cafeteria which provides facilities for 850 people in one sitting.

Other ancillary buildings, such as the 5-storey administrative block, nurses, hostel, doctors, hostel, guest house, central animal house, central workshop, laundry, shopping centre, sarais and parking lots, are suitably and functionally located within developed landscape.

The master plan of the campus was prepared by Le-Corbusier and his team, and ably assisted by P.L. Varma and M.N. Sharma - both winners of the award of the Institute-de-la-Vie of France - doctors and architects.

Engineering installations

The Department of Hospital Engineering & Planning, which is responsible for engineering services, estate management, new works etc. is divided into 13 major units for field activities. The specifications of installations and the operative policies for maintenance and operation are briefed below:

(i) Public-health services

(a) Water supply to the campus: Water supply to the campus, both filtered and unfiltered, is from the city's system. For the former there is an underground storage tanks of $1{\cdot}3 \times 10^6$ ($0{\cdot}3$ million gallons) capacity. There are two Kirloskar booster units (Fig. 3) of 22 and 9kW (30 and 12•5 h.p.) and a 40kW (54 b.h.p.) diesel engine. Since this storage is for 6h with a consumption of 22×10^4 l/h (50 000 gal) great difficulty is experienced, particularly during summer. The supply is therefore being augmented with the installation of two units of 15 and 30kW (40 and 20 h.p.). The unfiltered water supply is again inadequate and there are proposals to augment it by installing two tube-wells and linking them with the system. The filtered water supply to the hospital and research blocks is through 250 storage tanks, each being of 1800 (400 gall) capacity. The average supply of pressure is 100×10^3 - 140×10^3 N/m^2 (15-20 lb/in^2). The average supply per bed is 218 l/day/capita (48 gall/day/capita) against the Indian Standards Code recommendation of 135 - 230 l/day/capita (30 to 50 gall/day/capita).

The sewerage system consists of a network of 10 and 15cm (4 and 6in) S.W. glazed pipes and is linked with city's sewer system. The storm water drains consists of a network of 37•5 to 60cm (15 to 24in R.C. pipes).

(b) Hot-water supply: Hot-water is supplied through 120 indigenous geysers, ranging from 45 to 135 l/h (10 to 30 gall/h) having electricity-operated thermostatic control.

In addition, a central hot-water supply - the first of its kind in any Indian Hospital - has been installed. It consists of a boiler house (Fig. 4) with five boilers,

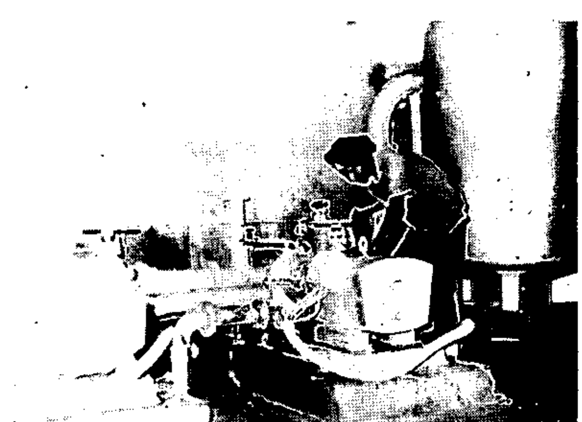


Fig. 3 **Booster pumping set**

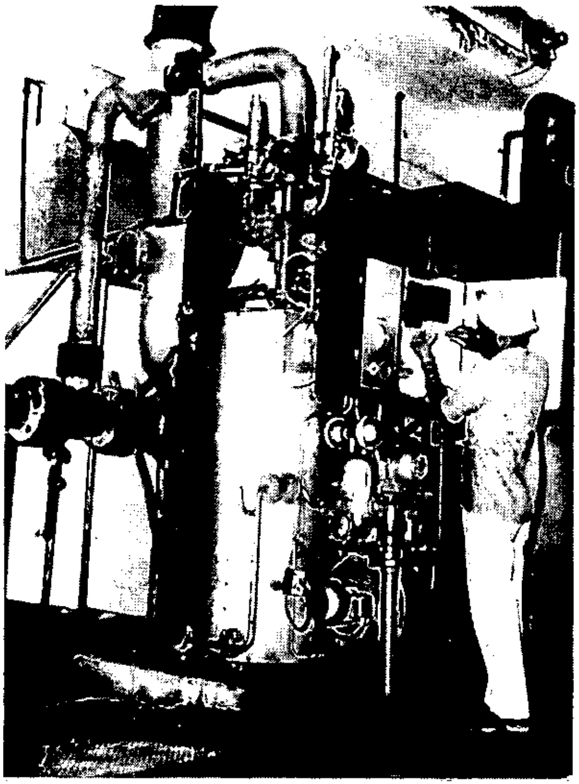


Fig. 4 Part of hot-water scheme

of which two are 600 kg/h (1320 lb/h) and three are of 300 kg/h (660 lb/h). The central supply has been provided to all general wards, private wards, o.p.d.s. Steam at a pressure of 550 x 10^3 N/m^2 (80 lb/in^2) is also fed from this system to autoclaving and central sterilisation equipment. There are proposals to augment the system for supplying steam to the kitchen for cooking and to private wards and the paediatric ward for heating during winter.

(c) Medical-gas system: The medical gas system consist of a central manifold room for supply of oxygen, nitrous oxide and vacuum for suction. 20 oxygen cylinders and eight nitrious oxide of 6m^3 (212 ft^3) capacity are fitted in the central manifold

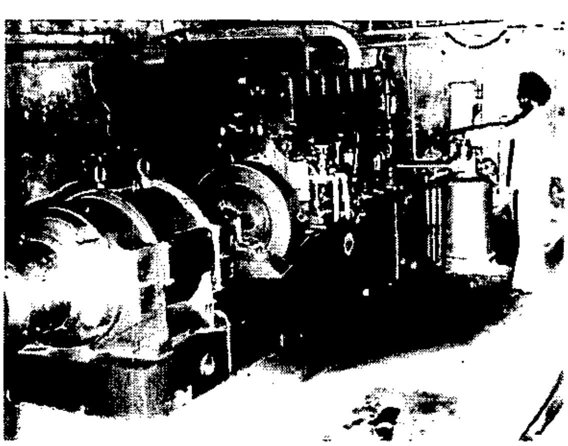


Fig. 5 Standby generating station

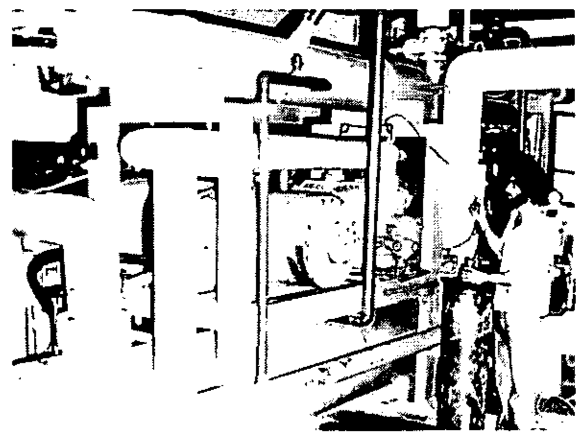


Fig. 6 Central airconditioning plant including a compressor-motor unit

room. The piped supply is, however, restricted to main operating theatres, emergency wards, private wards, the kidney unit and the neurosurgical ward. The supply to other areas is through cylinders.

(d) Gas plant: The gas plant with capacity of 370m^3 (13 000 ft^3) supplies fuel gas to all the experimental and research laboratories. There are no systems for mechanical ventilation or incineration.

(ii) Electrical services

(a) Electric supply and distribution: The Institute is supplied electric power by the City's supply systems at three different points through 750 kVA transformers. Apart from normal 11 kV feeders, the hospital is fed from a diesel feeder capable of taking full load of the Institute. The substations, along with the diesel feeder, are part of a ring-mains system, and continuity of supply is doubly ensured.

(b) Standby generation of electricity: Two 125 kVA generating sets (Fig. 5), located beyond research block A, generate medium voltage. This standby generation feeds the main operating theatres, labour room, autopsy room, blood-bank and vital points in research blocks A and B.

(c) Cable: All the main cables are of p.v.c. insulated aluminium, terminating in ducts situated in different blocks of the hospital and research blocks at level 1. There are rising busbars from level 1 to the top, from where they are distributed to various units.

(iii) Airconditioning and refrigeration services

The main operating theatres at levels 4 and 5, labour rooms, emergency operating theatres and intensive care units are centrally airconditioned. The central airconditioning plant (Figs. 6 and 7), erected in two phases, has five reciprocating type compressor units with installed capacity of 560 tons. The plant works on a chilled-water system and has automatic unloading arrangements, remote control of airhandling

Fig. 7 Central airconditioning plant including ancillary pumping sets

units and remote temperature sensing of various airconditioned areas. It also has automatic humidity controls. Humidification is done by fresh water to avoid water-borne - infection of growth of fungae etc.

All the above areas are airconditioned on a 100% fresh-air basis, and the air is not recirculated.

Heating of all the above areas is done through either reverse cycling or electric heating, although the latter is preferred in order to save maintenance of plant and equipment.

Apart from the above, there are over 200 standard windowtype units of different makes. The blood bank and e.n.t. have their own small central airconditioning plants with two units of 7·5 tons each. The refrigeration services include maintenance of about 200 refrigerators of different makes, about 85 deep-freezers ranging from -20° to -70°C, nine cold rooms, two hot rooms, and a number of cold centrifuges and incubators.

The repair workshop has a well-equipped refrigeration–repair section to maintain the services in working order. Burnt sealed units are also repaired, and rewound in this section.

(iv) Laundry plant and linen bank

(a) Laundry plant: The mechanised laundry plant is located at a distance of about half a mile from the hospital. 3000 items are processed every day and the transportation is by truck. The entire installation is the left over from the Defence Services during the 2nd World War. Since the laundry arrangements were not satisfactory, a working group emphasised the need for urgent renovation and replacements, as 'linen' is the first environment of the patient.

The entire laundry layout has been changed to prevent infection, and additional bay covering an area of $511 m^2$ ($5500 ft^2$) has been added to an existing plinth area of $1000 m^2$ ($10840 ft^2$). The whole layout has been planned to be capable of incorporating automation wherever possible. In the first phase, equipment consisting of boiler with softening plant, washing machine, hydroextractors, linen/blanket disinfecting unit, pressing machines, dry-cleaning unit, sluicing machine, drying tumblers and air-

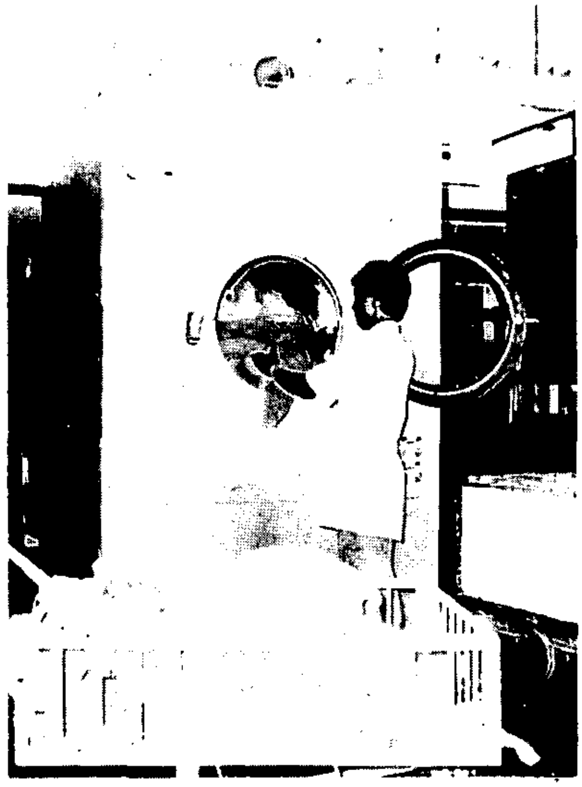


Fig. 8 Section of mechanised laundry plant

compressor were replaced in 1975. In the second phase, additional equipment, such as hydroextractors of 50kg (110 lb) capacity, drying tumblers of the same capacity, sluicing machine are proposed and pressing machines are to be replaced. The steam and electric lines are being augmented accordingly. Fig. 8 shows a drying tumbler.

(b) Linen bank: The linen bank is independent of the laundry plant and is located in the hospital. It is controlled by a technologist (textiles). His responsibilities are distribution of washed linen and collection of the same from plant. The dirty linen from various wards is also collected by the bank staff. The

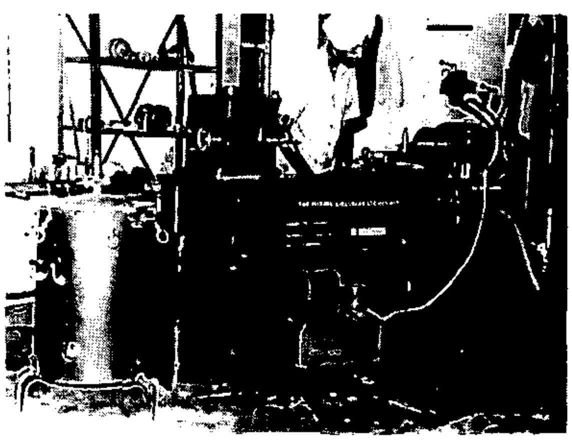


Fig. 9 Mechanical shop of central workshops

bank ensures proper storing, inventory and condemnation of the linen. The technologist being a textile engineer, offers help in the quality control of the linen purchased.

(v) Transportation and lift services

The Institute has 20 lifts installed in its various blocks. They are of various make and design. The horizontal transportation of goods, materials, food etc. is done through hand-driven trolleys via ramps.

(vi) Engineering workshop

The workshop is meant primarily for biomedical equipment, but is also equipped with certain other ancillary facilities. It covers an area of $1400m^2$ (15000 ft^2) with painting, airconditioning, instrumentation, rewinding, electronics, mechanical (Fig.9), black-smith, canning, tin-plating and carpentry shops already in existence. The automobile, electroplating and glass-blowing shops are being added.

The workshop has been approved as a regional one and assigned the following responsibilities:

(i) repair and maintenance of hospital equipment.
(ii) research, development and innovation for new hospital equipment
(iii) organising the maintenance and repair of all sophisticated equipment, e.g. X-ray, and controlling service contracts.
(iv) manufacture of articles of common use for the institute, mainly to utilise the spare capacity of men and plant.

All the equipment in the hospital and laboratories have been classified into following three types:

Type-I: the failure of which affects the entire hospital
Type-II: items of daily use such as suction machines, catherisation equipment etc.
Type-III: Sophisticated and ultra-sophisticated equipment, e.g. X-ray, computers, cobalt-therapy equipment etc.

The workshop is a very important facet of the hospital engineering department, and maintains/repairs 70% of the hospital's equipment. A number of innovations and new developments have been undertaken with the help of the medical faculty. We also supply hospital equipment such as a blue-light unit, a neonatal resuscitation trolley, a baby warmer, a premature baby incubator, an oxygen head box, a temperature shield, and infantometer—all developed in the workshop—to various other hospitals in the country. We also receive equipment from other hospitals for repair and send our repair teams to their hospitals.

(vii) Civil-engineering services

The annual repairs, white-washing, painting etc. for buildings, houses, hospitals, hostels, roads etc. are the responsibility of this wing. The work is done departmentally. All the minor work of additions and alterations are also undertaken by this unit. A master maintenance plan is drafted annually to undertake the works.

(viii) Horticultural services

A technologist (horticulture) with a team of 100 gardeners is responsible for a nursery 18·2 ha of lawns in the institute and residential campus, growing vegetables in 0·9 ha for the animal house and development of new lawns. Indoor potted plants have been placed in the hospital wards and corridors.

(ix) Engineering stores

Sound inventory control is the back-bone of maintenance and operation, particularly when the services are handled departmentally, otherwise labour losses are of a very high order. Up to 2500-3000 items are processed and stored every year. Stores management is a difficult task, but a good deal of success has been achieved owing to the intensive work done.

(x) Capital works

All new work plans are handled departmentally. Recently, a doctors hostel, a nurses hostel, a boiler house, staff houses, and laundry plant have been completed. The necessary tools and plants have been maintained. There is a net saving of 15-20% against the employment of a contracting agency.

(xi) Estate management

All PGI estate is controlled by the estate management section, which is responsible for handling eviction cases, allotment of houses, garages and shops, managing parking lots, both internal and external telephones, assessment of rents and issue of rent-receipt certificates, verification of electricity and water bills and controlling and managing all estate property.

(xii) Training

Hospital engineers are likely to share their training/teaching assignments in the postgraduate course in Hospital Administration wherever topics on maintenance, planning have to be studied. A post-diploma and postgraduate course in the field of hospital engineering and planning is being contemplated to train engineers, architects and middle managers.

(xiii) Other administrative duties

Hospital engineers are permitted effective participation in the operation of hospital and other policy-making bodies. These duties include: giving technical advice to the medical superintendent in the purchase of hospital equipment, preparation of notes and follow-up action on behalf of the director of the building committee; and working as members of the house-allotment committee, telephone committee, hospital council, operating-theatre management committee, infection control committee and the institute-functions/sports committee. In addition, all administrative work regarding recruitment of all members of the staff in the technical wing.

(xiv) Operating manuals for technical services

For the guidance of operating staff, the following manuals have been printed: also, the accounting procedure of the ministry of works has been completely changed to suit the need of the hospitals. The manuals published are: (1) Manual of accounts procedure, (2) Laundry manual, (3) Estate management manual, (4) Building-maintenance code - three parts, (5) Workshop manual, (6) Lift-operation manual, (7) Central airconditioning plant operation manual, (8) Central hot water-supply plant operation manual, (9) C.S.S.D. plant operation manual, (10) Preventive-maintenance manual, (11) Mechanics manual, and (12) a hand-book of trade-tests for technicians.

These manuals are being distributed on request to other hospitals in the country.

Conclusion

The experiment of re-organisation of technical services under the 'unified control' of hospital engineers being conducted at PGI, Chandigarh, is 'unique' and probably first of its kind in the Government institutions. Hitherto, the system was hierachical; partly under the Ministry of Works and partly under the medical superintendent.

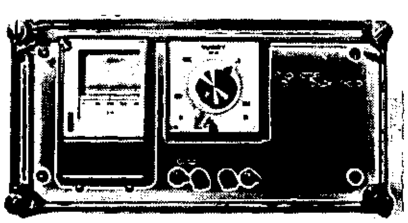
The philosophy of PPM and PMM has yielded a better upkeep of hospital equipment, plant and buildings. The officer-oriented approach has reduced bureaucratic delays by 30%. Other hospitals in the country are appreciating the changes. We hope and pray that this speciality advances, as, in developing countries, there is a greater need to conserve and optimise resources.

Mr. Mehta is head of the Department of Hospital Engineering & planning, Postgraduate Institute of Medical Education & Research, Chandigarh, India

HE Product news

Recorder and alarm unit

The E2111 series of equipment provides an analysis on how costs are incurred by producing a record of electricity consumption. It has been designed for those consumers whose electricity demand is too small to justify the costs of more complex



equipment such as multistage load-shedding units. Optional alarm points are available which may be used to energise warning devices or automatically switch off selected loads if target maximum demand levels are exceeded.

Gulton Europe Ltd., Brighton BN2 4JU, England

Emergency lighting

A new range of emergency lighting units in both self-contained version and slave units suitable for centralised supplies is available, based on the Trimline range. Circular units are available with either prismatic or opal diffuser and rectangular units with an opal diffuser or exit lettering. The cells in the self-contained units are nickel cadmium, giving a duration of 3h.

Marlin-Merchant Adventurers Ltd., Feltham, Middx. TW13 6DR, England

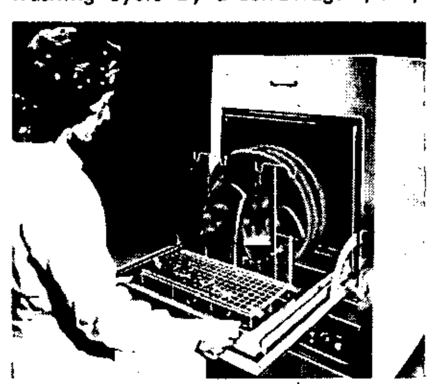
Coalescing filter

This filter is designed to clean effluent water and remove oil traces and other insoluble organic compounds from water. It filters and coalesces oil droplets which can then be removed from the system by periodically draining the filter unit. It is intended to deal with final clean-up of trace contamination and is said to be capable of reducing the final oil concentration to levels of 1 part in 10^6. Effective filtration is also achieved in the presence of emulsifying and stabilising agents.

Balston Ltd., Springfield Mill, Maidstone, Kent, England

Anaesthetic-equipment washing machine

This machine is designed to wash and rinse equipment automatically and in under eight minutes for the wash/rinse cycle. The anaesthetic equipment to be cleaned is placed on a stainless-steel manifold which incorporates a series of jet tubes and spigots on which selected items requiring internal jetting are placed. Face masks and similar items go in a stainless-steel wire basket located within the carriage. In operation, the detergent solution is recirculated at 60-75°C during each washing cycle by a centrifugal pump



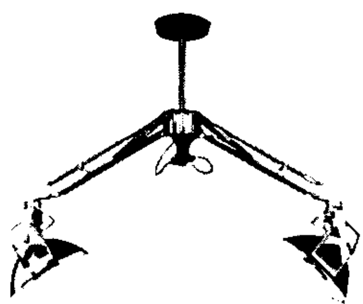
from the wash tank into the frame manifold, providing jetting onto all the internal surfaces. Simultaneously, detergent solution is delivered from revolving stainless-steel jet arms situated above and below the frame manifold.

Dawson MMP Ltd. Abbey Works, York Road, Waltham Cross, Herts., England

Product news

Examination light

The light, known as the model 415, provides an output of shadow reduced, cool, colour-corrected light and is intended to fill the gap between a full theatre light unit and the often inadequate adjustable lamp.The reflectors produce 85-90% specular reflection and fall off from this value is claimed to be less than 2% during the useful life of the unit. The lamps are

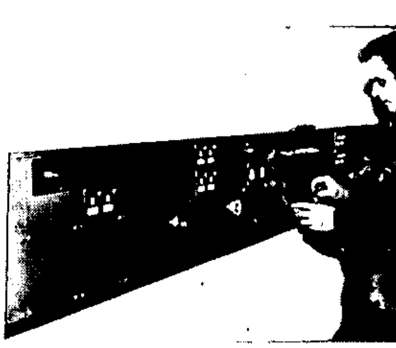


150W spotlights enclosed in heat absorbing, colour corrected, glass cylinders. The model 415 can be ceiling or wall mounted. The standard length ceiling mounting pillar is 45cm and a 73cm version is available as an option.

Medisco Equipment Ltd., 52-54 Peascod Street, Windsor, Berks., England

Trunking

This trunking carries cables, wiring, and small-bore pipes in three separate but adjacent ducts. Known as Walsall type T4, the trunking is designed to be

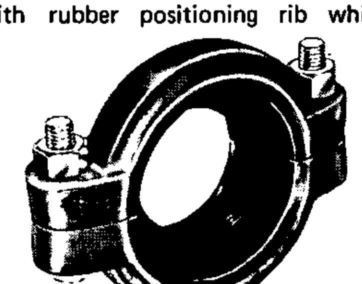


mounted on interior walls and is 333mm high and 76mm deep. It is available in lengths up to 3m. Outlets for services installed in the trunking are mounted on modular cover plates 178mm wide, retained by chrome-headed screws. Blank covers 534mm wide are fitted to runs of trunking where no outlets are required. The trunking and its covers, and associated corner sections, tees and other accessories, have a stove enamelled grey finish.

Walsall Conduits Ltd., Dial Lane, West Bromwich, W. Midlands B70 0EB, England

Pipe coupling

Two different pipe sizes may be connected on the same run using the number 160 Gruvagrip coupling. Designed for use with grooved end pipe, it replaces a reducer fitting and two couplings and uses a one-piece gasket with rubber positioning rib which



assures proper positioning of the gasket over the pipe ends and tends to keep the pipe from telescoping.

Aeroquip Corp., Jackson, Mich.49203, USA

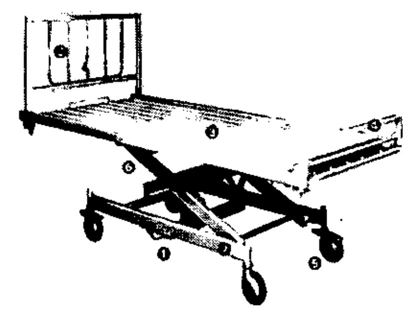
Antistatic shoes

An antistatic shoe for use in hospitals has been designed by Dunlop Footwear Ltd. The shoe, available in both men's and women's styles, has a non-marking white p.v.c. sole. Both shoes have white canvas uppers with a white p.v.c. 'apron' and injection-moulded white p.v.c. soles. The soles have an electrical resistance within the limits 50 Ω to 50 MΩ, this is achieved by the addition of an ionic material to the p.v.c.

Dunlop Footwear Ltd., Walton, Liverpool L9 1DH, England

Variable height

The concept of the Kingstyle bed is based on a standard specification that can be supplemented by optional additional or alternative features. Standard features include foot-operated hydraulic variable height from 391 to 686 mm. Optional extras for the bed include the provision of instant head down and reverse tilt, and a full width slide-away bedstripper. Alternative features include the



Unicon King's Fund integral backrest head end and panelled foot end.

Ellison Hospital Equipment Ltd., Code 'K', Wellhead Lane, Perry Barr, Birmingham B42 2TD, England

Telewriter

Cygnet is a person-to-person communication system that will transmit handwritten messages, diagrams and signatures for verification. Messages can be transmitted over direct private wires, through private or public telephone circuits or through appropriate radio links. Whatever the route, messages are received as fast as the operators can write. Three basic units are available, a transmitter, a receiver and a transceiver, enabling both one-to-one and multi-unit systems to be built up.

The message is written either on roll-fed plain paper or on sprocket-fed printed forms, using a ball-point pen for both transmitting and receiving messages.

Feedback Instruments Ltd., Park Road, Crowborough, Sussex TN6 2QR, England

Communication links generated by a patient in the Health Service

by Prof. K.B. Haley

The first approach a patient makes to the Health Service is usually through his family practitioner and some methods of modelling this involvement are described. The basic concept is a diagram which shows the links that exist between the various communications activities and is due to J.B. Peacock. One study is used to illustrate some of the needs of a communications system. The use of this approach in the article is *post hoc,* but it does provide a linking between the activities and illustrates its value.

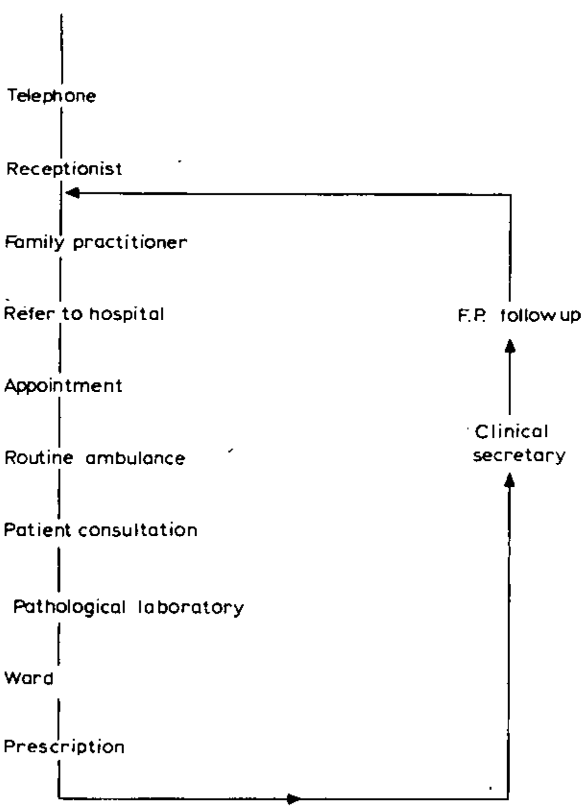


Fig. 1 Patient contact

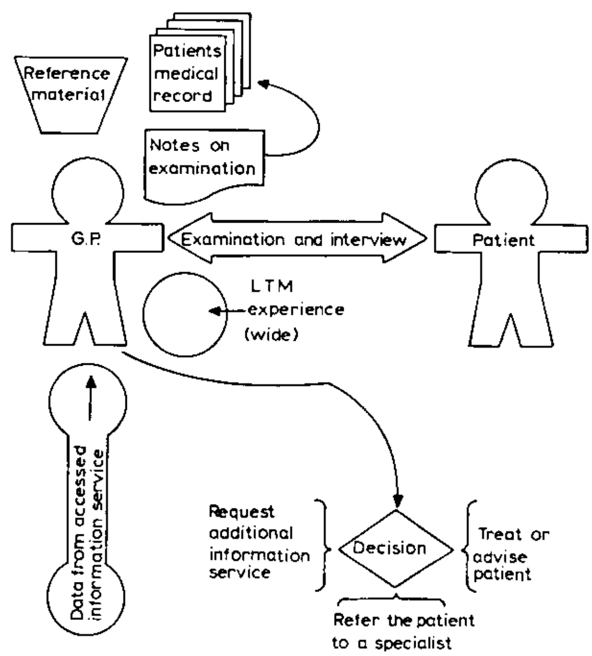


Fig. 2 G.P. consultation

Primary medical care

In the United Kingdom, there are about 22 000 family practitioners, each of whom acts independently and is individually able to control his activities. Although there is no one body directly responsible for organisation, the Royal College of General Practitioners conducts investigations and advises doctors on their research. This paper will draw on studies carried out jointly by the Royal College and the operational-research team of the department of engineering production.

The form of contact is frequently of the form shown in Fig. 1, which, excluding accidents, leads to a visit to the family practitioner. The patient will be examined and interviewed and some action taken. This action might be in the form of direct advice or treatment of referral to some other agency. Schematically, this consultation is shown in Fig. 2, where the examination and interview, combined with records, notes, existing data and the doctor's own long-term memory and experience, leads him to make

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a decision which is of three basic kinds, i.e. treatment, refer or more information. Fig. 3 defines the symbols used. Around this framework of activity, it is possible to identify many problems of organisation and management as well as examples of technical or clinical need. These questions have been posed by general practitioners and some have been tackled. The types of exercise undertaken involve:

(a) the method a patient seeks an appointment and the nature of the appointments system
(b) method of arrival at the surgery
(c) consultation information on the use and significance of stated symptoms, elicited (asked for) symptoms and medical tests
(d) recording methods
(e) retrieval methods
(f) referral habits and evaluation
(g) diagnostic services
(h) use of ancillary staff (nurses).

Various aspects of diagnosis and treatment are often considered and particular approaches evaluated. For example, some studies have indicated a possible influence of morbidity of housing, weather, home environment, electromagnetic and electrostatic forces, drinking water etc.

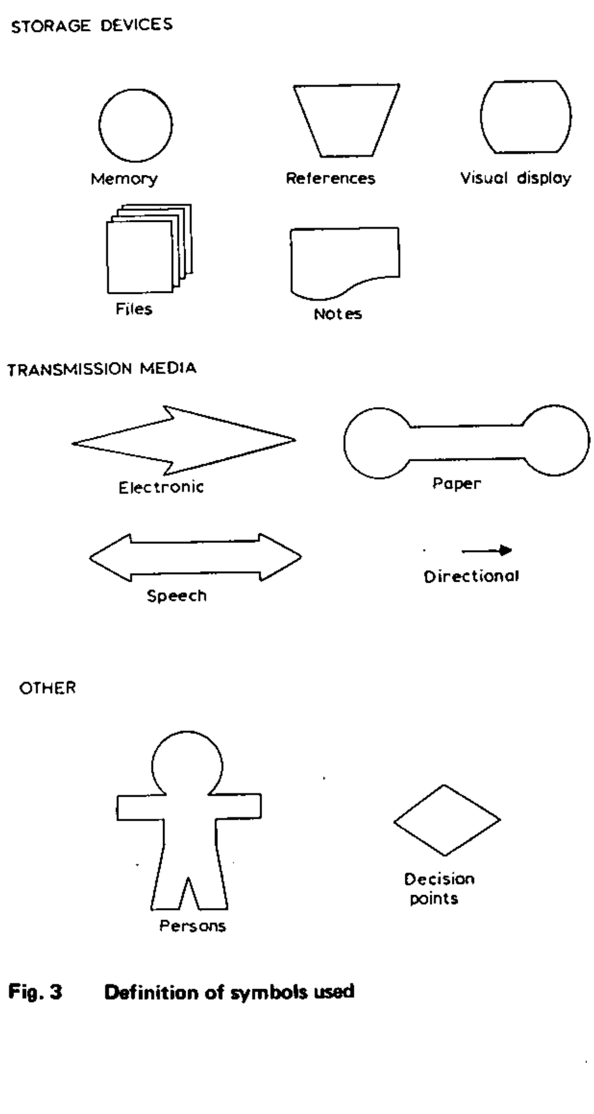

Fig. 3 Definition of symbols used

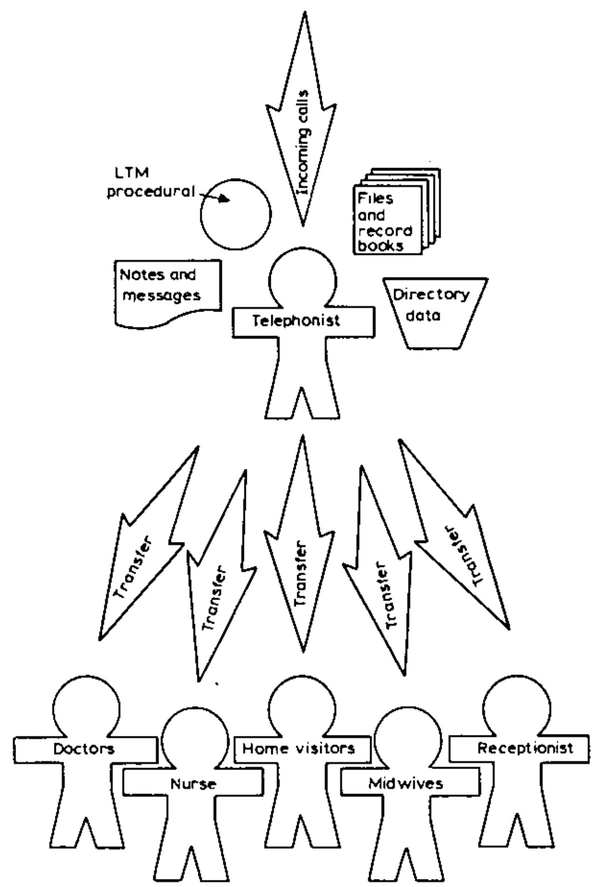

Fig. 4

Use of the model

Each of the areas listed separately in Fig. 1 can be modelled in the same way but the next few Figures give examples of the method. In contacting a family practitioner clinic by telephone, a patient directs the telephonist to consult various services before transferring the call to the necessary individual adviser. This one-way flow, shown in Fig. 4, is repeated when the receptionist receives a direct or telephone contact, Fig. 5. Both these activities should be combined to give a more complex chain when other contracts are included. The effect of this is shown in Fig. 2, the effect of the decision 'refer to specialist'. The result of this action is shown in Fig. 6. This complex case shows the involvement of many more people, records and systems. An emergency admission would eliminate some letters and preliminary appointments and substitute a direct link to the consultant via a telephone call to the casualty officer.

Hospital referral

During the last quarter of 1970, a study was mounted in an East Midlands city to determine the standard of service received for outpatient, emergency admission and specialist domiciliary consultations. As reported by Fraser, Patterson and Peacock, the study involved the completion of questionnaires by 18 doctors who

Table 1 Waiting Time: Outpatient referrals

	Days	0-3	4-7	8-14	15-28	29-42	43-56	57-84	85-112	113-140	Over 20 wks	TOTAL
Routine	NHS	10	18	44	71	134	62	60	44	2		445
	Private	9	27	28	37	15	4	3	2		2	127
	Total	19	45	72	108	149	66	63	46	2	2	572
Priority	NHS	31	19	24	20	1			1			96
	Private	8	8	6	4							26
	Total	39	27	30	24	1			1			122

Table 2 Waiting time for preliminary reports

Days	0-3	4-7	Over 7	Never	Total
Routine	76	69	61	366	572
%	13·3	12·1	10·7	63·9	
Priority	37	10	11	64	122
%	30·3	8·2	9·0	52·5	

Table 3 Waiting time for final reports

Days	0-3	4-7	8-14	Over 14	Never	Total
Routine	115	152	94	133	78	572
%	20·1	26·6	16·4	23·3	13·6	
Priority	21	28	16	39	18	122
%	17·2	23·0	13·1	32·0	14·7	

Table 4 Missing reports

	Number of Patients	No prelim reports received	No full reports received	No reports received
		%		
Outpatient	694	63%	14%	5·5%
Casualty	103	70%	63%	5·2%
Obstetrics	65	21%	61%	6%
Domiciliary	43	24%	39%	0%
Emergency	163	19%	26%	8%
	1068	568 55%	260 24%	108 10%

Table 5 Mean waiting time for reports

	Prelim report		Full report	
	Days	% Received	Days	% Received
Outpatient	7	37	15	86
Casualty	5·6	30	12·8	37
Obstetrics	4	79	18·6	39
Domiciliary	Same	76	7	61
Emergency	2·9	81	21·2	74

made about 33 000 patient contacts during the period. About 3·25% , or 1068 patients, were referred to hospital and information was obtained on various waiting times. Full details are recorded by Fraser *et al.*; but, for illustration only, the data on outpatients and delays to reports are considered here.

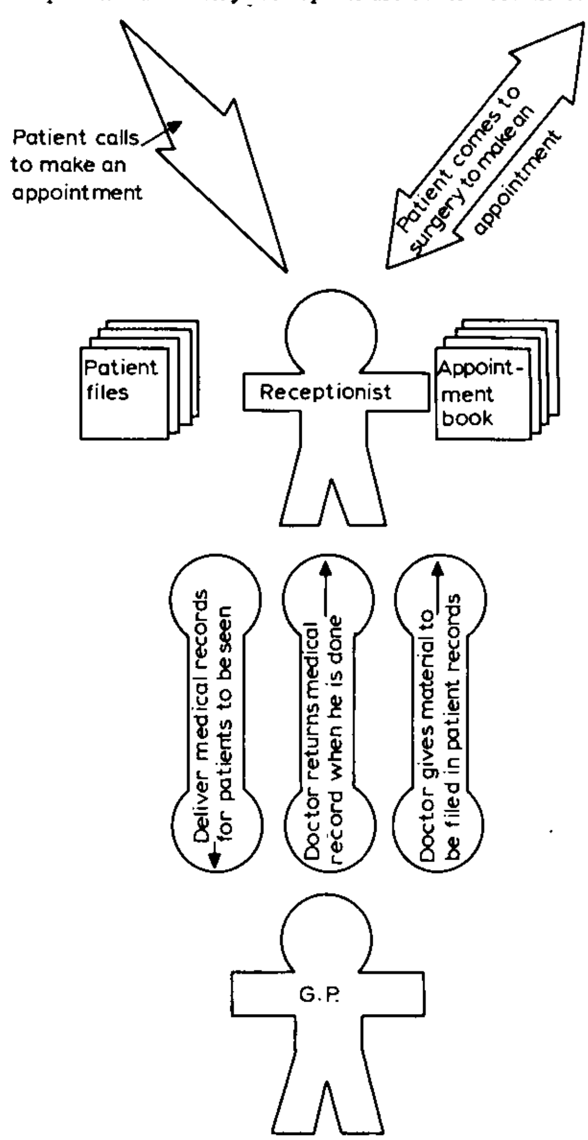

Fig. 5

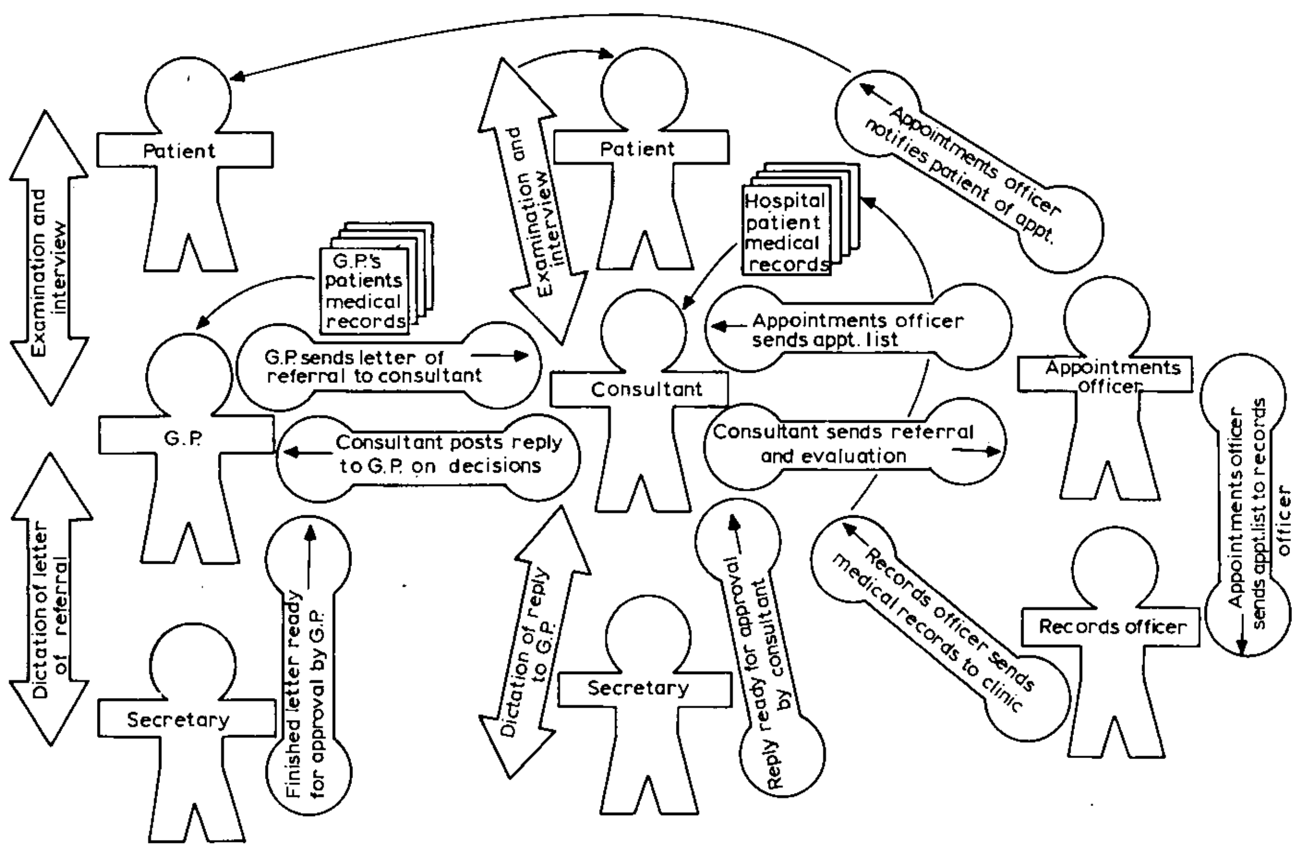

Fig. 6 Referral system

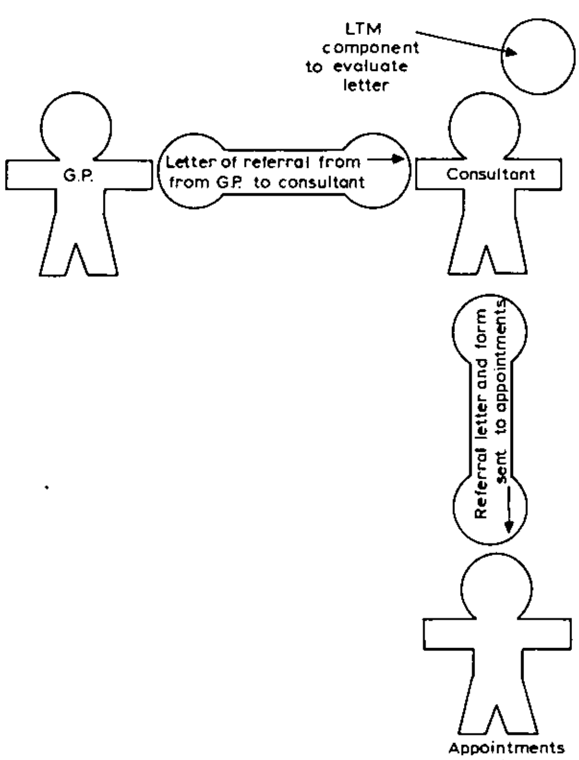

Fig. 7 Referral evaluation

Fig. 7 shows the referral evaluation using the model. In this situation, information was gathered and analysed concerning outpatients waiting time shown in Table 1. The figures are divided into routine and priority NHS and private. Tables 2 and 3 are concerned with the delays in reporting from the consultant to the general practitioner of both preliminary reports and final reports sent after the patient has been discharged to the care of the general practitioner. Table 4 gives details of missing reports, and Table 5 the mean waiting times for referrals in different categories.

The collection of this data and its subsequent analysis enabled the group of doctors to make suggestions for ways to improve on delays and also to correct some misconceptions.

The paper has tried to give a way of describing the communications needs of a patient and doctor in the Health Service. The important of particular methods are emphasised when their variety is clearly seen and the model facilitates this.

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PEACOCK, J.B. (1973), The current state of communications in the health and personal social services, O.R. Soc. National Conference.

FRASER, R.C., PATTERSON, H.T., and PEACOCK, E. (1974), Referrals to hospitals in an East Midlands City - a medical Audit. Royal College of General Practitioners, 24, 304-319

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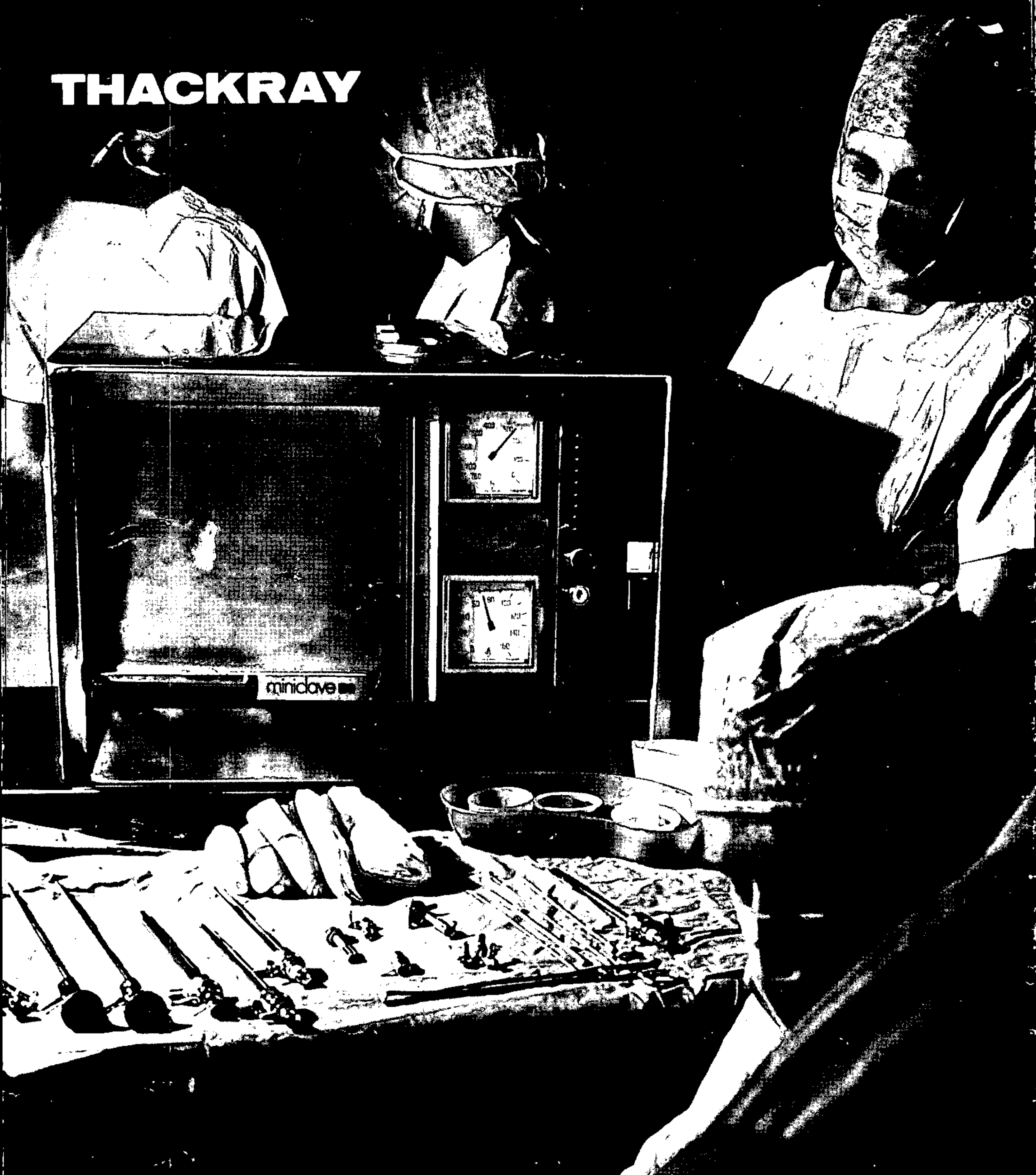
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