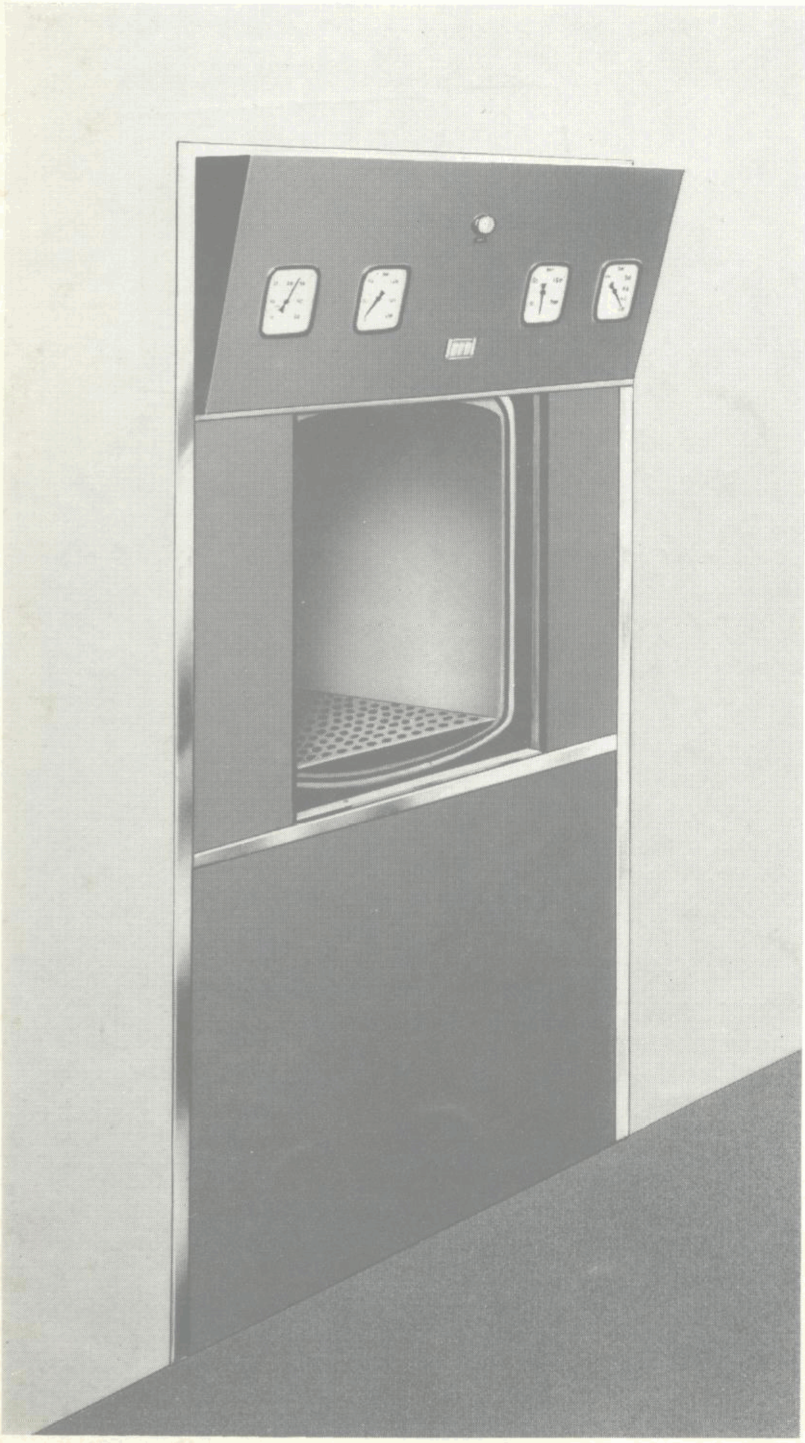
THE HOSPITAL ENGINEER

THE JOURNAL OF THE INSTITUTE OF HOSPITAL ENGINEERING

VOL XXII No 9
SEPTEMBER 1968

FOUR SHILLINGS



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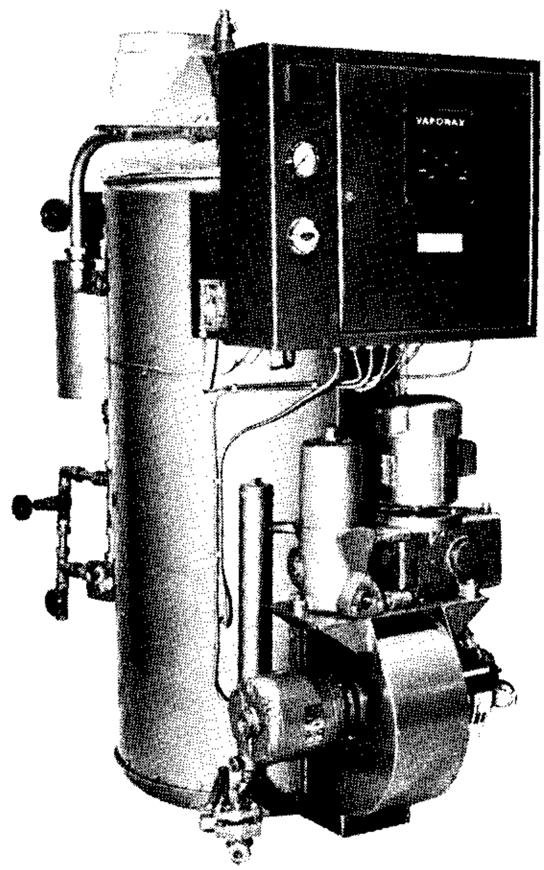

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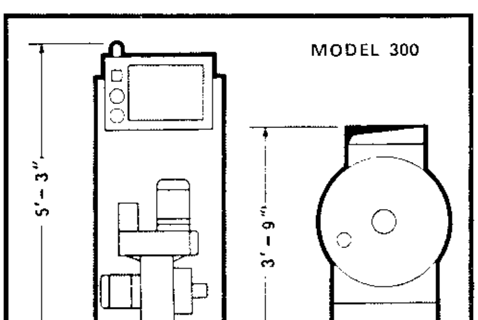

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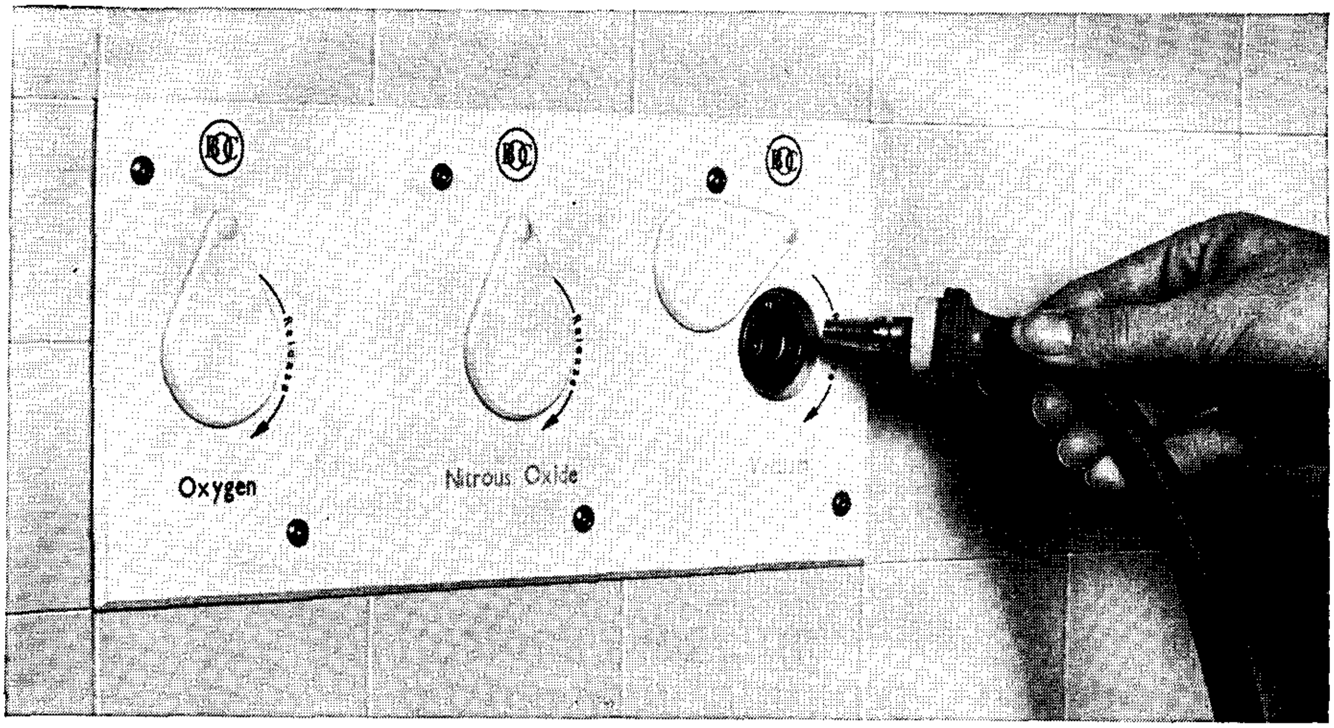

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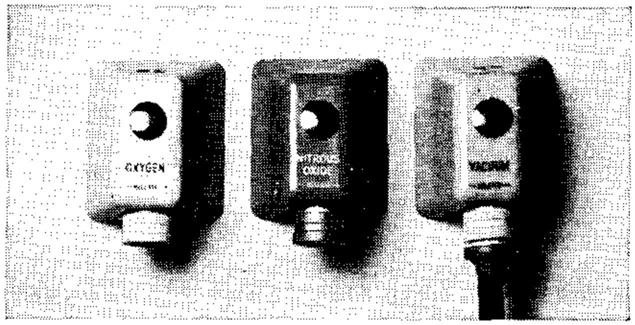

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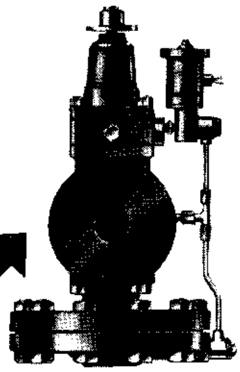

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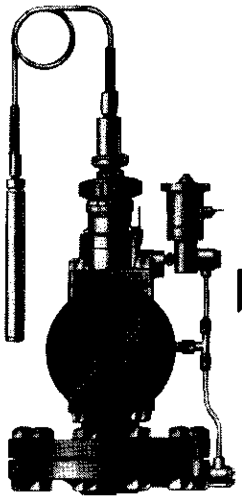

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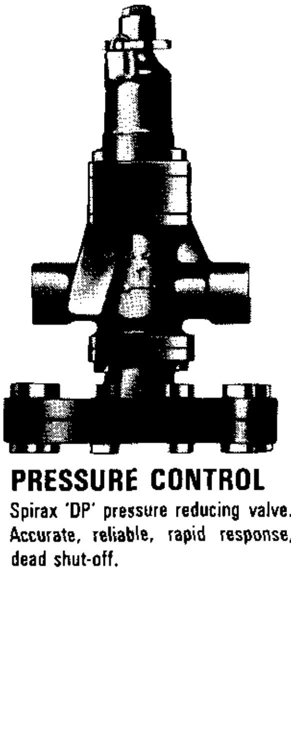

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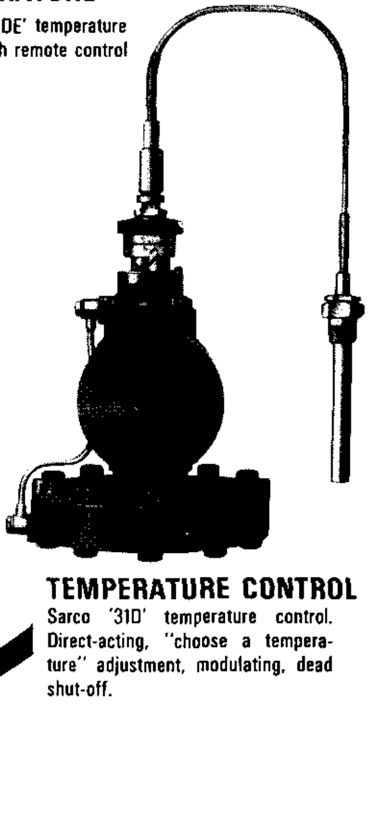

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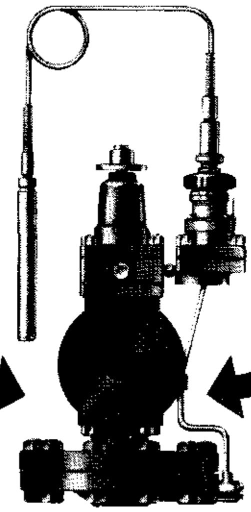

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CONTENTS

193 **Electrical Services in Hospitals Part 1**

198 **The Importance of Automatic Fire Detection Systems in Hospitals**

201 **Controlling the Noise of Emergency Generating Plant**

204 **The Effects of Commissioning on Superintending Engineers**

208 **Abstract of Reports**

209 **B.S.I. News**

211 **On the Market**

214 **Notes for Members**

216 **Index to Advertisers**

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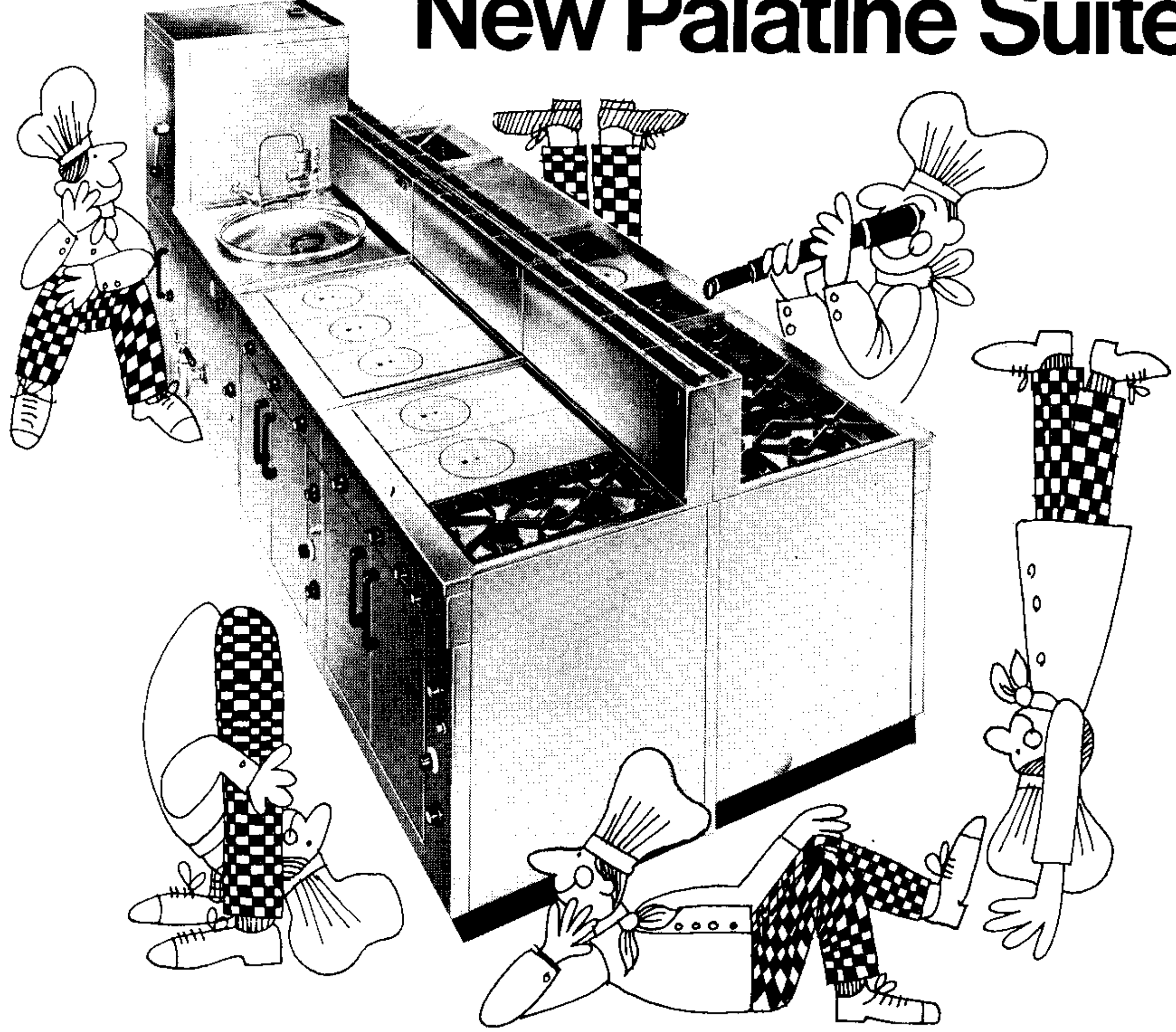

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THE HOSPITAL ENGINEER

THE JOURNAL OF THE INSTITUTE OF HOSPITAL ENGINEERING

VOL XXII No 9
SEPTEMBER 1968

Electrical Services in Hospitals

PART 1

By J. H. LEVERTON, B.Sc.(Eng), C.Eng., F.I.E.E.,
Assistant Regional Engineer, N.E. Metropolitan R.H.B.

Introduction

TRENDS in design and treatment techniques of a modern hospital have increased the dependence which must be placed on an uninterrupted supply of electricity at all times and have also increased the consumption and maximum demand values which must be catered for in a well designed installation. The principal factors bringing about these increases are:—

(*a*) Modern architectural trends to compact blocks which inevitably will include many internal rooms devoid of natural lighting and ventilation.

(*b*) The use of multi-storey blocks which will include one or more banks of lifts for vertical transport. With increasing heights the speed and, therefore, horse-power of lifts will increase.

(*c*) The necessity for pumping all water supplies to multi-storey blocks.

(*d*) Increased size of circulating pumps necessary to meet increased heads in hot water and heating circuits.

(*e*) Developments and increasing use in solid fuel handing and oil firing for central steam boilers.

(*f*) The increase in use of refrigerators for domestic uses (food preservation and preparation), air conditioning and medical purposes (blood storage, serum storage and operating techniques).

(*g*) The use of modern electro-medical equipment of all types.

(*h*) Increasing treatment of patients by means of physio and occupational therapy.

Initial Investigation

The planning of electrical installations must commence at a very early stage in the design of any project, in order to determine within reasonable limits the space which will be required for the accommodation of switchgear, distribution gear, rising bus bars, etc.

The earlier in the planning stage that these requirements are made known to the Architect, the easier it will be to provide adequate accommodation to facilitate subsequent maintenance operations.

The needs of the Electrical Installation must be integrated with those of other services at this stage, to make the maximum use of all ducts, crawlways, etc.

A draft Technical Memorandum is, at the present time, circulating in the Boards which enables a rapid assessment of total plant space required to be made at both the initial and sketch plan stages. It also sets out the areas required for individual plant rooms.

Mains Supply

The main supply will almost certainly be obtained from the network of the Local Electricity Authority and it can be assumed that the maximum demand figure for a General Hospital will be of the order of 2 kVA per patient, excluding any abnormal loads, such as large scale ventilation or space heating and laundries, but planning should allow for an increase to 3 kVA in the future.

There are three methods by which a supply can be afforded, viz:—

(1) At Low Tension from the Authority's network.

(2) At Low Tension but with a transformer station on site which will be the property of the Authority and which may be for the sole use of the hospital, or may feed other premises in the locality.

(3) At High Tension (11 kV).

The method of supply will be related to the maximum demand:—

A paper read at the I.H.E. Group Engineers' Course, Keele University 1968.

(*a*) *Low Tension supply from Network*
This will be limited to a maximum of about 100 kVA and is, therefore, only likely to be used in the case of very small premises. A limited standby is usually obtained by triangulating transformers on the L.T. network, so that in the event of the failure of one transformer limited supplies will be available at all points from the other two.

(*b*) *Low Tension from Transformer on Site*
Supplies of this type will be afforded for maximum demands between the limits of about 100 and 750 kVA. The H.T. switchgear and transformers will be the property of the supply authority who will generally pay a rental for the site, which must be securely fenced. Weyleaves will be required for the entry of cables into the site and also access for men and materials for the purpose of maintenance. A 1000 kVA sub-station will require approx. 600. sq. ft. of space 7′ 9″ high.

(*c*) *High Tension Supply*
An 11 kV supply will probably be offered when the maximum demand exceeds 750 kVA. In this case the provision and maintenance of H.T. and L.T. switchgear and transformers will be the responsibility of the Hospital Authority. Most Electricity Boards will provide the H.T. switchgear, but will call for a contribution to cover part, or all, of the cost. The design should include for at least two transformers but the cost of holding a spare to cover breakdowns is not warranted, as Electricity Boards will be found most co-operative in the event of a transformer failure and will usually lend or rent a temporary replacement and give assistance with temporary connections, etc. For this purpose it is usual to provide transformers to the same specification, capacity and dimension as those used generally by the Electricity Board.

The transformers should be sited as near the load centre as circumstances will allow.

Outdoor transformers need fencing and tend to be unsightly but, on the other hand, the cost of a building to house indoor gear can well be high. The housing in basements of buildings may entail the cost of permanent CO_2 fire extinguishing systems. The use of air cooled transformers obviates the need for this provision, but as they cost approximately twice that of an oil-filled unit, are heavier and more bulky, they are probably not an economic proposition.

The fault level at the point of the incoming supply must be obtained from the Electricity Board in order to determine the short circuit capacity of the switchgear.

In calculating the short circuit capacity of M.V. switchgear, it should be noted that most manufacturers are now producing switchgear with a short circuit capacity of 31 M.V.A. which enables 2×1 M.V.A. transformers to be paralleled on a system where the fault level is 125 M.V.A. on the E.H.V. side. This has been derived from the experience of Electricity Boards who have found that this is adequate capacity for most distribution requirements.

Typical short circuit capacities are listed in the table below.

E.H.V. Fault Level	*No. of Transformers*	*M.V. Fault Level (M.V.A.) for Transformer Rating*		
		1,000 *kVA*	750 *kVA*	500 *kVA*
250 M.V.A.	One	18	14	10
	Two	34	27	18
125 M.V.A.	One	17	13	9
	Two	30	24	17

Fire Precautions

It is preferable to locate the transformers outside the E.H.V. switch rooms (i.e. in fresh air). If this is not possible, they should be housed in isolated cells to avoid the use of CO_2 equipment. M.V. switchgear associated with a sub-station, should be in a separate room from the E.H.V. switchgear, to avoid the use of CO_2 equipment. Air circuit breakers (A.C.B.'s) should be used where practicable in preference to Oil Circuit Breakers (O.C.B.'s) and in Distribution Centres the use of oil filled equipment should not be considered.

Precautions against Electric Shock

It is not necessary to provide rubber mats for switchboards, since all switchboards including starter panels and distribution fuseboards are of the enclosed metal clad type. Hence, a rubber mat would offer no protection and could mislead a person into having a false sense of security.

It is required, however, to provide a 3′ 0″ wide clear passage way in front of all switchboards as described above and in the case of free standing switchboards, where access for maintenance is required behind the board, the 3′ 0″ clear passage way is to be provided back and front.

Portable transformers, provided by the Hospital Management Committee, may be used in sub-stations and distribution centres, etc. for use with low voltage hand-lamps and as 1:1 transformers for portable tools.

Electric shock notices (S.O. Form 731) must be displayed alongside "Electricity (Factories Act) Special Regulations 1908 and 1944" (S.O. Form 954) in all switch rooms and plant rooms.

Protection of 11 kV switchgear and transformers

11 kV Switchgear may comprise oil filled fuse switches or O.C.B.'s. If O.C.B.'s are used, it is important that they are not fitted with under voltage release, and it is Hospital Board policy to use over-current and earth fault (O/C and E/F) protection as described in C/66, p.16 of

T.M. No. 7. The use of inverse definite minimum time (I.D.M.T.) relays and D.C. shunt trip coils should not generally be necessary for hospital installations.

However, the protection of the incoming 11 kV switchgear is the prerogative of the Electricity Board who may call for this type of protection. It is important in negotiations to obtain the facility for the hospital staff to be able to trip the incoming O.C.B.'s (usually by remote push button) in the event of emergency.

Entry into E.H.V. switchrooms

In the event of E.H.V. switching operations being necessary, they are to be carried out by an Authorised Person, hence it must be impossible for any other person to gain access to an E.H.V. switchroom unless admitted by an authorised person and issued with a permit to work certificate. Where there are Sub-Stations on hospital premises containing Electricity Board Equipment it may be necessary on occasions for certain Hospital Staff to have access to the E.H.V. switch rooms. In such cases it is important to negotiate this requirement in the initial discussions with the Electricity Board.

Practically no hospitals carry an electrician qualified to act as an Authorised Person and we are fortunate in our area that, so far, the Electricity Board has, in all cases, agreed to make such a person available at all times. It is necessary to provide all mimic diagrams, key boards etc. that may be required. In some areas Boards are not so co-operative. The Sheffield Regional Hospital Board has recently issued a publication describing how they cover the availability of an Authorised Person from Regional Hospital Board Staff.

Alternative Supplies

The modern underground H.T. network in urban areas is reasonably reliable, but it will be found that areas supplied by long lengths of overhead line may be subject to lightning disturbance and are more liable to failure. A fault on an H.T. network can lead to very large areas being deprived of supplies and this must be borne in mind when arranging for alternative services.

Any proposals should be examined very carefully to ensure that the origin of supply is as nearly independent of that of the normal supply as possible.

In the case of a supply at L.T. from the L.T. network, reliance must be placed on the interconnection between transformers at other points on the network.

For supplies from transformers on site, it is usual to loop in from an H.T. ring to a point as near to the transformer as possible and avoid long lengths of single cable. Additional safeguard is afforded by L.T. interconnection to other transformers in the district. The provision of an alternative H.T. supply is desirable, but it should be remembered that it will not be possible to run such supplies in parallel and switching control will be retained by the Electricity Authority. The total cost of such an alternative supply must, as a rule, be borne by the consumer, since the Electricity Authority cannot anticipate any additional revenue from such an arrangement.

Main switchgear

Main switchgear must be housed in a room specially set aside for this purpose and to other services, particularly water, gas or drainage should enter or pass through this room and it should, of course, be sited so as to give the easiest possible access for incoming cables and also to both vertical and lateral internal distribution cable routes.

The incoming mains from the Electricity Authority must terminate in a main isolator which for capacities of about 750A and over should be a circuit breaker fitted with overcurrent releases, but for smaller capacities may take the form of a switch fuse fitted with H.R.C. fuses.

The board itself may be either of the cubicle pattern, or made up of individual items mounted on an angle iron framework. The latter, although cheaper, will certainly occupy more space than the cubicle type and is relatively unsightly. All boards must be capable of extension in the future and provision should be made for the accommodation of as such as possible of the supply Authority's equipment, i.e. cut outs, current transformers, meter panels etc. Those parts of the board which are connected directly to the incoming mains, prior to the meters must be capable of being sealed.

Metering in the form of an ammeter in each phase and a voltmeter with selector switch should be provided. Earth leakage protection may be required when reliable earthing facilities are not availabe, but in most cases the supply Authority will provide a satisfactory earth connection. All other main services must be connected to this earth connection at their point of entry to the building.

The board should be fitted with bus bars of adequate capacity to which all outgoing feeders should be connected by means of suitable switch fuses with H.R.C. fuses of the correct rating. Links in all outgoing circuits to enable portable ammeters to be connected will be found a great asset when balancing loads, particularly in a large installation.

Every item on the Board must be clearly labelled and the labels should bear the following information.

(1) The capacity of the unit.
(2) The destination of the connected cable.
(3) The phase or phases to which it is connected.
(4) The area or particular item of equipment it controls.
(5) Danger notices where called for by regulation.

A large scale schematic diagram of the board should be mounted behind glass or perspex on the wall of the room and it is convenient to have a second copy printed on linen which can be used by the staff working on the board.

Adequate lighting must be provided at both back and front of the board together with sockets for inspection lights and small tools. The wiring for all services within the room should, if possible, be so connected that it is available for use even when the board is isolated for maintenance or alterations and additions.

A rack of clips should be provided to house spare H.R.C. fuse cartridges together with any spanners or link handles. The clips should be labelled with the appropriate cartridge capacity and arranged so that it can be seen at a glance when replenishment is required. Provision should also be made for a telephone extension connected to the internal system, and the telephone number of the day and night emergency call for the supply Authority clearly displayed.

Main Distribution

Main distribution will generally take place at Low Tension unless the site is extremely spread and there are widely spaced areas of heavy loading. The decision on each site will be made purely in consideration of economics. It is comparatively cheap to arrange for L.T. interconnection of two adjacent transformers to provide stand-by in the case of failure but, where transformers are dispersed, some form of L.T. interconnecting cables may be required and the dual L.T. and H.T. cabling may affect any savings that may be made by the adoption of H.T. distribution.

Horizontal distribution should, in general, take the form of a ring main and vertical distribution the form of vertical bus bar trunking.

In designing a ring main system use should be made of paper insulated, P.V.C. insulated, or aluminium cored lead sheathed cable. M.I.C.C. cable may be used but the largest size of 4-core cable has a carrying capacity of 85 amps although single core cable up to 400 amps capacity can be obtained. The size of the ring will generally be determined from voltage drop considerations rather than load carrying capacity and, providing that certain loads such as X-Ray equipment, lifts etc. are fed direct from the main distribution point, the voltage drop in emergency when part of the ring may be out of action can be allowed to rise above the normally accepted values.

Each end of the ring should terminate in a separate switch fuse with H.R.C. fuses of the correct rating and the ring looped into the various feeder points which should be either outdoor feeder pillars or internal panels. The pillars should be provided with links, not fuses, for the connection of the ring as it is not possible to grade fuses to provide discrimination and, in the event of a fault occurring, it is possible that any fuse in the ring may blow and valuable time will be lost in tracing blown fuses, particularly as fuses for different phases may blow at different units.

The feeder cables to the distribution centres in the blocks should be connected to fused units in the pillars or panels and adequate spare units must be provided for future extensions. Each pillar or panel must be provided with clips holding spare H.R.C. cartridges and any tools necessary for removing or replacing links or fuses. Provision should be made for the temporary connection of ammeters. Each unit must be clearly labelled and a diagram showing the destination of each cable and the rating of each H.R.C. fuse should be permanently fixed inside the cover.

In the 14th Edition of the I.E.E. regulations (A.10) allows for increasing the rating of cables which are protected with fuses given "close" protection. This is defined as fuses having factor not exceeding 1·5 and will include all class P and class Q1 fuses to B.S.88. However, as the size of cable is usually determined by voltage drop, rather than carrying capacity, if fuses of the correct size for the load are installed the question of "close" or "course" protection will not arise. It is essential to ensure that replacement fuses are of the same rating as those originally installed.

The routes of cables will be designed in conjunction with those of other services. Where large subways are provided it is usually possible to arrange for one wall or even the roof to be kept clear of all piped services and used for cable services of all types.

Where small ducts with removable covers are provided for services, cables may be laid direct in the ground outside the duct, even if these run parallel, as it minimises the danger of cables being damaged when subsequent maintenance operations are carried out on mechanical services.

All branch cables should be not less than 18 feet below ground level and covered with purpose made warning tiles. Where passing under roads or paths, the depth should be increased in accordance with the traffic on the road and should be enclosed in salt glazed pipes in order to facilitate withdrawal at a later date, if necessary. The provision of spare ways for cables, for other services, and for future extensions, should be arranged, Concrete cable markers should be installed on all routes on which should be indelibly inscribed the distance of the cable from the marker. Except in the case of excessively long runs, markers need only be provided at the beginning, end, and at points of change in direction of the route. Adequate marking and accurate plotting of the exact positions of all site cables on a block plan will help to avoid accidental damage to cables as the result of future building operations. The block plan should also indicate the position and number of spare ducts under roadways etc. in order to facilitate their location at a future date.

Where hangers are provided in ducts etc., spare ways should also be provided for future extension and also for cable for other services.

Access to vertical ducts should be available for the full height, floor to ceiling and should be available from areas where maintenance operations can be carried out with the minimum interference to the occupiers of the building.

If possible, the ducts should be large enough to house the main distributing gear for each floor, mounted on the wall beside the bus bar trunking and deep enough for maintenance operations to be carried out by personnel working within the space and not congesting the area outside.

The distribution of other electrical services, i.e. radio, staff location, telephone, fire alarms etc. should be housed in the same ducts especially where divided trunking is used for horizontal distribution, as this will facilitate the entry of these services into the appropriate section of the trunking.

Adequate lighting should be provided on each floor and a socket outlet, both fed from an independent source. Fire stops must be installed at every floor to comply with the fire regulations.

It must be remembered that the Regulation D.29 of the I.E.E. Regulations states that the resistance of the Earth Conductor (including cable armouring, trunking, conduit etc.) shall not be more than twice that of the largest current carrying conductor. This means that certain types of cable may not be used unless a separate Earth Conductor is provided.

Sub-Distribution

The location of sub-distribution boards should be related to both accessibility and load centres. Flush type boards should be provided and, if possible, sited so that work can be carried out on them without blocking circulation areas. They should never be sited in store rooms or other rooms which are liable to be cluttered up or locked, so that access to the gear is not readily available at all times. Each board should be fed by a separate feeder from the main distribution centre and ready means of isolating each board separately should be provided. The horizontal runs should be of P.V.C. insulated cables run in trunking housed in false ceilings where available, or otherwise concealed within the building structure.

Distribution boards may be supplied either as composite units comprising ways of different ratings for various services all in one enclosure, or separate boards may be provided for each rating. In either case adequate spare ways must be provided and access must be readily available for future wiring from these spare ways into the trunking or other horizontal distribution system.

In order to provide a balanced loading over the three phases it will be necessary to divide large single storey buildings into clearly defined areas, each of which will be connected to one phase, but with vertical buildings of limited floor area it is more convenient to connect each floor to one phase. In order to facilitate balancing, it is advisable to arrange that the connection of any one board to any phase is possible, but as such changes occur only rarely, it is quite unjustifiable to provide elaborate or expensive means of carrying this out. Some modern equipment, such as waste disposal units and dishwashers now being provided require a 3 phase supply. Generally, such equipment will be confined to the utility areas and a study of the plans will indicate the most likely sites and provision can be made accordingly.

All fuses should be of the H.R.C. cartridge pattern of appropriate rating and provision should be made for the housing of spare cartridges in the enclosure. The circuit list in each board should indicate the correct rating of cartridge for each way and should be arranged so that where spare ways are used, the list can be amended in a neat and legible manner.

The use of Miniature Circuit Breakers is increasing and these have certain advantages over fuses, but are more expensive. When used in distribution boards they eliminate the necessity and cost of holding stocks of spare cartridges and with their free handle device enable circuits to be restored without the need to isolate the whole board.

M.C.B.'s may very conveniently be used in the case of large areas, such as laundries, etc., where the majority of the lighting will be controlled from one central point. They may be used as the sub-switches for the circuits and will effect considerable saving in such circuit wiring. Where fluorescent lighting is used, these should be rated at 15A and each lighting unit be equipped with a fused connector block, thus allowing a large number of fittings to be controlled by one breaker on one circuit. When M.C.B.'s are used, it should be checked that the rating chosen will have characteristics such that certain discrimination will take place between them and H.R.C. fuses in the sub-main distributor gear and that the possible fault currents are within their rated rupturing capacity.

Although sub-distribution using V.R.I. or P.V.C. insulated cable run in heavy gauge screwed metallic tubing has been traditional for many years, increased use is being made of plastic conduit.

This however will be limited, since it provides no screening and cannot therefore be used in areas where E.C.G., E.E.G. and E.M.G. equipment may be used used which is virtually in all clinical areas, and it will, of course, be necessary to provide a separate insulated earth wire for all circuits.

Reference has already been made to the requirement of Regulation D29 whereby the resistance of the Earth Conductor shall not be more than twice that of the largest current carrying conductor. This applies to conduit and trunking and it may be necessary to provide separate insulated earth wires to meet the requirements. In any case regulation D5 calls for an insulated tail between a terminal in the box and the earth terminal of all 3 pin socket outlets even where a conduit system is used for earth connection.

The arrangement of circuits should be considered in relation to the use of various areas, so that isolation may take place without interference to adjacent areas. In operating theatre suites, in particular, each theatre and its ancillaries should be capable of being completely isolated for maintenance purposes, while all others are in use. The use of colour code is helpful here, all fuses, isolators, etc., being marked in an appropriate colour to identify the particular theatre they control. Colours should be chosen so as not to be confused with phase identification colours.

(*To be continued*)

The Importance of Automatic Fire Detection Systems in Hospitals

By SIR FREDERICK DELVE, C.B.E., M.I. Fire E.
Director, Sound Diffusion, Ltd.

THE tragedy of the fire at the Shelton Hospital near Shrewsbury in February last in which twenty-four women mental patients lost their lives, followed later in the same month by a fire at the Royal Devon Exeter Hospital, Exeter, where fortunately there was no loss of life, focuses attention on the urgent need for automatic detection of fire in Hospitals (Mental and others) and especially those in which there is a high life risk; also to the importance of Fire Brigades receiving the earliest possible call to a fire however small the outbreak may be.

The Minister of Health, answering questions put to him in Parliament, announced that the fire precautions and conditions in certain hospitals were to be reviewed. In March he announced that a public inquiry would be held into the Shelton Hospital fire. This inquiry lasted 12 days and was concluded on the 16th July.

Readers of this Journal, who saw the newspaper reports on the Coroner's Inquest and the later Inquiry, cannot fail to have noticed two very important factors, (i) the delay in calling the Fire Brigade, and (ii) the fact that no one was available to deal with the fire in its early stages. No doubt these two points will be dealt with in the Inquiry Report and appropriate recommendations made to ensure that neither occurs again in the future. It would appear from the newspaper reports that, had the Fire Brigade been called immediately the fire was discovered, an early attendance whilst the fire was in its initial stage would probably have averted the tragic loss of life that followed.

Unfortunately, delays in calling the Fire Brigade happen all too frequently. Indeed, much of the damage caused by fires could be reduced if only Fire Brigades received a call the instant a fire originated. It probably is well known that fire damage in the United Kingdom last year exceeded £90 millions, which figure is the highest ever recorded. The losses for the first five months of the present year are 23% up on those for the corresponding period last year. In far too many instances buildings are well alight before a fire is noticed and the Fire Brigade called. Many senior fire officers experience annoyance and frustration when, upon arriving at a fire, they find that the building is doomed to destruction simply because they have been called too late. In such circumstances their expertise in fire fighting is necessarily confined to "containing" the fire and preventing it from spreading to adjoining property.

It seems highly illogical for the Government and Fire Authorities to spend vast sums of money annually to maintain efficient and well-equipped Fire Brigades and, through lack of a call, for them to remain idle in their Stations whilst undetected fires rage in the vicinity.

The Factories and Offices Shops, etc., Acts require premises to which provisions of the Acts apply to have fire warning systems installed. But, as these systems are manually actuated, there is often no one to use them if an outbreak of fire occurs after working hours and it is not surprising therefore that two of every three large fires occur when premises are unoccupied. Millions could be saved annually and life better safeguarded if it were to be made a requirement that in all buildings of high life or fire risk provision should be made for any outbreak of fire whenever and wherever it occurs to be instantly detected and the nearest Fire Brigade automatically called.

Fire Officers are only too well aware of the apathy that exists about fire. Always it is a case of the other fellow being unfortunate and never oneself until fire strikes suddenly and without warning and the sufferers find themselves woefully unprepared. However, in fairness it should be stated that this general charge of apathy does not apply to the Ministry of Health, at least as far as giving advice on fire precautions is concerned. As long ago as April, 1956, the Ministry issued to all Regional Hospital Boards, Hospital Management Committees, and Boards of Governors an admirable booklet on safety from fire in existing hospitals. The booklet is very well produced and contains some useful information on subjects such as consultation with fire authorities, fire precautions, fire fighting, fire drills, fire equipment, water supplies, planning for action in case of fire and other related matters. Unfortunately the information was tendered in the form of "advice" and there appeared to be no obligation on the part of the recipients to act on it. Although the booklet is comprehensive in its scope, very surprisingly only one very small paragraph is devoted to the important subject of automatic fire detection. Possibly like many other bodies and individuals this is not regarded as being important—until it is learned how disastrous a fire can be.

However it has already been stated that the booklet was issued twelve years ago and possibly more detailed advice has been given to the authorities named since then. At least it is hoped so in view of the increasing concern at the continuing rise in fire damage and the staff turnover and shortages in hospitals which does not permit many staff trained in fire duties to be quickly available in emergency.

In all the circumstances, therefore, it may be unwise to attempt to prophesy what recommendations might appear in the Inquiry Report but, if the newspaper reports on the two fires referred to are reliable, as I think they are, it is fairly certain that a principal recommendation will be the provision in all hospitals of a suitable fire warning system, supplemented where necessary by an automatic fire detection system especially where there is a high life risk, also in areas within hospitals where combustible materials are stored and visited infrequently.

In case this prophecy is confirmed it may be helpful to Hospital Boards and Management Committees and especially to Hospital Engineers who probably will be the most concerned in advising on suitable systems and their maintenance, if I utilise the remaining space available in this article to automatic fire detection systems.

First of all a few words about the types of system that are available. Broadly, they fall into three categories viz.: Thermal or Heat, Smoke, and Infra-red radiation. Experiments are currently taking place at the Fire Research Station to determine the effectiveness of the Laser beam as a detector and, from all accounts, the results are stated to be promising.

Hospital Engineers are no doubt fully conversant with the principles on which the systems actuate and with building characteristics and detector siting. If detailed information is required on these matters an excellent paper was prepared on the subject in 1965 by M. J. Dogherty, B.Sc.(Min.), B.Sc., Dip.A.M., of the Joint Fire Research Organisation, copies of which can probably be obtained on application to H.M. Stationery Office. This paper contains a great deal of useful information on the principles of the systems but it does not deal at all with the equally important aspects of any system, namely the circuitry and control equipment. My observations therefore apply particularly to these matters.

In the first place it is fundamentally important that any system must be absolutely reliable in all circumstances especially having regard to the responsibility it carries, be it a high life risk in a hospital or protection of valuable machinery and materials in factory premises. To fulfil this requirement, in my opinion, a system must therefore always fail to safety and never to danger. Indeed, not only should the wiring be on a "closed" circuit, but as a further safeguard the detectors should normally be "closed". Engineers will know that it is always more certain for a contact to "open" than "close", especially in places where the atmosphere is liable to corrode contact points.

Secondly, all primary components of the system should be constantly supervised and monitored so that whatever fault may develop, be it a severance of cable, earth or faulty mechanism, instant warning would be given visually and audibly. Engineers may well enquire if a system exists which fulfils all these important requirements. Certainly, Sound Diffusion's "Auto-Thermatic" Fire Detection, which is approved by the Fire Offices Committee, does and no doubt there are others.

The Auto-Thermatic System includes specially designed equipment for hospitals occupying a large area and having widely scattered buildings. The Littlemore Hospital, Oxford, is a typical example. Psychiatric patients are not always aware of the dangers of fire and it was primarily for this reason that the Littlemore Authority decided to provide cover against all fire risks. Occupational therapy, including industrial, electrical, joinery, and toy workshops necessitates storing combustible materials within the buildings so that detectors were considered necessary in all work areas as well as in twenty-one wards and in residential and administrative sections.

Embracing all these buildings within one detection system was a technical achievement in itself. The Mark IV Auto-Thermatic Fire Detection System is designed around the "ring main" principle which requires only one cable running in a loop within the perimeter of the site area. At Littlemore each of the 47 detector systems is then wired into the ring main at the appropriate point. An added advantage is that since the ring main encompasses the site it will be possible in the future to equip any new buildings that may be built in much the same way as extending an existing water or electricity supply.

The facia panel of the central console unit is divided into two sections containing detection lamps, duplicated for safety, and control facilities. All circuits are constantly monitored and self-checking. Any breakdown results in an alarm being given. Daily circuit tests can be made by a switch which causes the equipment to "hunt" throughout the system, regardless of its size or complexity, in less than twenty seconds whilst giving visual indication that each detector is working satisfactorily.

The foregoing describes the Mark IV system for hospital buildings within a large area such as at Littlemore, St. Francis, Haywards Heath, and others. Available also are other systems embodying the principles of reliability referred to that are appropriate for smaller hospitals and, indeed, for all kinds of buildings, industrial and commercial.

Now a few words about the fusing rate of detectors, as this matter also is important. Excluding fires which involve highly flammable liquids and highly combustible materials, most outbreaks are small at the time they originate. Therefore the sooner they are detected, and the Fire Brigade automatically called, the quicker the Brigade will be in attendance and the more likelihood there is of the fire being confined to its place of origin. It is simply common sense therefore to ensure that the fusing rate of detectors should be as low as possible. However, in determining the correct rating for a detector regard must be paid to the normal ambient temperature and provision made for any rise that might occur due to reasons other than fire, e.g., abnormal heat from the sun through roofs or windows. If the rate is decided without all relevant factors being considered it is probable that false calls will be given by the system which, if repeated frequently, will result in some penalty being imposed by the Fire Authority. However, this can and should be avoided by instituting a thorough survey before determining the lowest practical temperature and in exercising intelligence in siting the detectors.

Sound Diffusion have given a great deal of thought to this matter and, in a number of hotels in London, they are using detectors which actuate on a temperature as low as 120°F. This is the lowest practical temperature and should result in any outbreak of fire being detected at the earliest possible moment and the Fire Brigade being automatically called. This should prove invaluable to Fire Brigades, especially if lives are endangered which is always possible at fires in hotels and hospitals where the life risk is high.

Finally, in case there should be any doubts in the minds of readers about the effectiveness of automatic fire detection systems, I would refer them to the Ministry of Technology, Department of Scientific and Industrial Research, Fire Research Note No. 589—Preliminary investigation of fires fought by Fire Brigades with 5 or more jets. One of the principal conclusions reached was: "Had automatic fire detection systems been installed in all the buildings and linked directly to the Fire Station or combined with security patrols in the vicinity it is very likely that the size and, consequently, the cost of many of the fires would have been greatly reduced".

For further proof, if any is needed, in the Report of Her Majesty's Chief Inspector of Fire Services for the year 1967, it is stated (para. 32) "The value of automatic fire detection systems, which detect and give early warning of fire is well known, and it is of interest to record that, during the period under review, 650 calls were automatically transmitted to fire brigades over the direct connections mentioned above".

Confucius is reputed to have said "The obvious is sometimes the most difficult to see". How very true this is when from all quarters Ministers, Government Departments, Industry, and Insurance one hears concern expressed about the steeply rising fire losses.

It is right that concern should be expressed by those in responsible positions as it is not generally appreciated that the £90,000,000 lost in 1967 is only the "known" loss, that is the total of the claims admitted by the Insurance Companies. But, added to this must be the unknown losses and these include loss of production and trade which at this period are vitally important to our economic recovery; loss of good will, loss of skilled staff and resultant employment. No figures can be given of these and other consequential losses as they are stated to be incalculable. It may be that they would equal and possibly exceed the £90 millions.

It is therefore in the national interest that positive action should be taken to stem this continuous and unnecessary drain on the nation's wealth. There are two practical steps that would go some way towards this. One is to require all premises of high fire and life risk to be protected in the manner suggested earlier in this article. The second is for the Insurance Companies to give greater encouragement to their insured by way of incentives to install automatic fire detection systems connected directly with Fire Stations, the systems actuating on the lowest practical predetermined temperatures.

A leading Insurance authority, referring to the fact that the fire losses for the first six months of 1968 were one-third higher than in the same period last year, stated that never before had the Insurance Companies had to face such a staggering rise in fire damage, and that the loss was equivalent to every householder in the country throwing a £5 note on to the fire. In the light of this statement surely the time has come for some serious re-thinking on the part of Insurance interests and reappraisal of attitudes. If this is not done, once again will the insured be called upon to foot the bill by way of increased premiums or re-rating of premises.

£600,000 ROYAL MARSDEN EXTENSION

A 22-BED fully air-conditioned "sterile" ward of the type experts believe is best suited to deal with the needs of infection-prone patients, is one of the advanced features being incorporated in the new £600,000 extension to the Royal Marsden Hospital, Sutton, Surrey, building of which is due to begin in September.

Expected to be one of the best equipped units of its kind in Europe when completed, the ward is intended primarily for the treatment of leukaemia. Modern drugs used to combat this disease—as with organ transplants—suppress the body's natural defence mechanism against infection, making sterrile conditions essential for survival.

A Royal Marsden spokesman commented: "Although we do not at the present time envisage that the sterile ward will be used for the treatment of transplant patients, surgery is moving so rapidly in this field that it would be unrealistic not to take it into account."

When completed, the extension will add 76 beds to the 95 at present in use at Sutton.

Two new general wards will each be divided into five single and five four-bed rooms. Two single rooms in each will be especially equipped to deal with patients being treated with implanted isotopes.

There will also be a children's ward and an operating theatre suite equipped to carry out the most advanced surgical techniques. Out patients', physiotherapy and occupational therapy departments are being provided, together with additional space for the hospital's pathological and X-ray units, and a central sterile supply department.

Architects for the new extension are Lanchester & Lodge, Eastbourne Terrace, London, W.2, and the consulting engineers, R. W. Gregory & Partners of Feltham, Middlesex.

The Sutton hospital is part of the Royal Marsden, Fulham Road, London, S.W.3, which, when it was founded over a century ago, was the first hospital in the world to specialise in the treatment, teaching and research into cancer.

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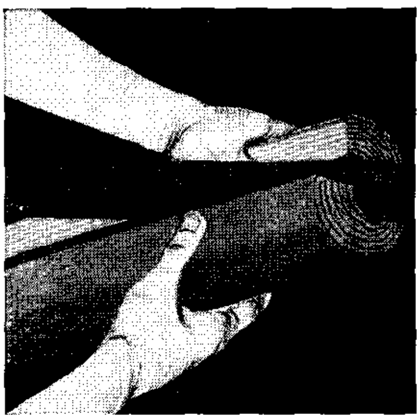

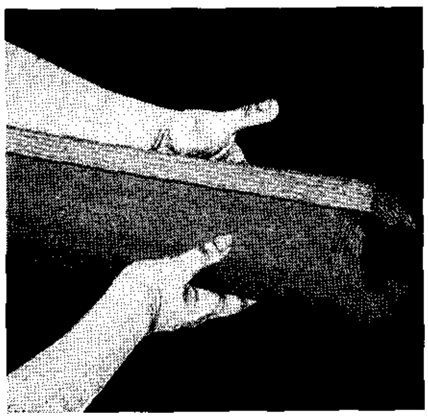

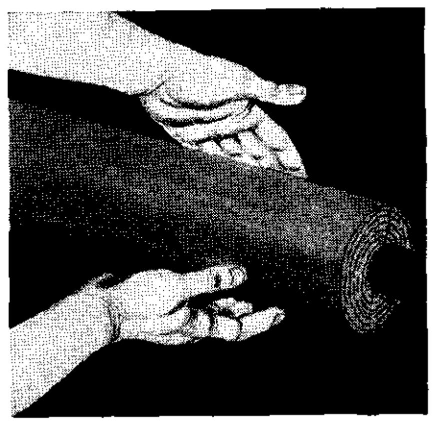

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Controlling the Noise of Emergency Generating Plant

By A. C. WATSON, B.Sc.

THE provision of emergency generating plant in hospitals has increased noise within the precincts of hospital sites and brought to the fore the need for special attention to this problem.

In most cases it is a relatively inexpensive matter to control noise provided the problem is properly considered at the design stage, and, to assist engineers, Austinlite Ltd., of Gatwick Road, Crawley, Sussex, have set down basic factors as a general guide when dealing with emergency power requirements in hospitals.

Obviously, the simplest method of avoiding a noise problem is to install emergency generating plant remote from ward blocks or other critical hospital buildings. Where space allows, this solution is satisfactory since full advantage can be taken of the fact that sound pressure falls in relation to distance by an inverse square law which, in the case of unrestricted hemispherical radiation, results in a reduction of 6 dB for each doubling of distance from the noise source. However, siting power installations remote from the hospital areas which need emergency power increases cabling costs and, as many hospitals suffer from a space problem, this solution is not always practicable. For these reasons, it is desirable to site standby power installations close to or within the hospital buildings.

Two problems arise from such installations. Firstly, the problem of noise transmitted from the power room to adjoining rooms in the same building, and, secondly, air-borne noise transmitted from the power room to nearby buildings.

Good quality anti-vibration mountings, flexible piping and ductwork connections will effectively isolate a power installation from the fabric of the building. To prevent direct transmission of noise through this medium, however, careful selection of the anti-vibration mountings is necessary. Mountings which isolate in terms of vibration will not necessarily effectively isolate from noise unless they have been selected to suit floor deflection characteristics.

The problem of air-borne noise requires more detailed consideration.

Air-borne noise transmitted through the walls, floor, and ceiling to adjoining rooms can be limited by normal standards of building since, for example, a 9 inch brick wall or a floor or ceiling consisting of a minimum of 7 inches of concrete having a density of not less than 100 lbs. per cubic foot will ensure considerable reductions in sound pressure through transmission losses. Figure 1 shows in graphical form a guide to the order of transmission loss in each frequency band through typical walls, ceilings, and windows. On the same graph will be found curves showing sound pressures in each frequency band of typical diesel or gas turbine driven emergency power plant. By subtracting the pressure reductions in each frequency from the corresponding figures shown on the octave band analysis curve of the generating plant, it is possible to construct a curve showing the sound pressure readings in each frequency band which can be expected in parts of the building adjacent to the power room. This curve can then be compared with the noise criterion curves shown in Figure 2.

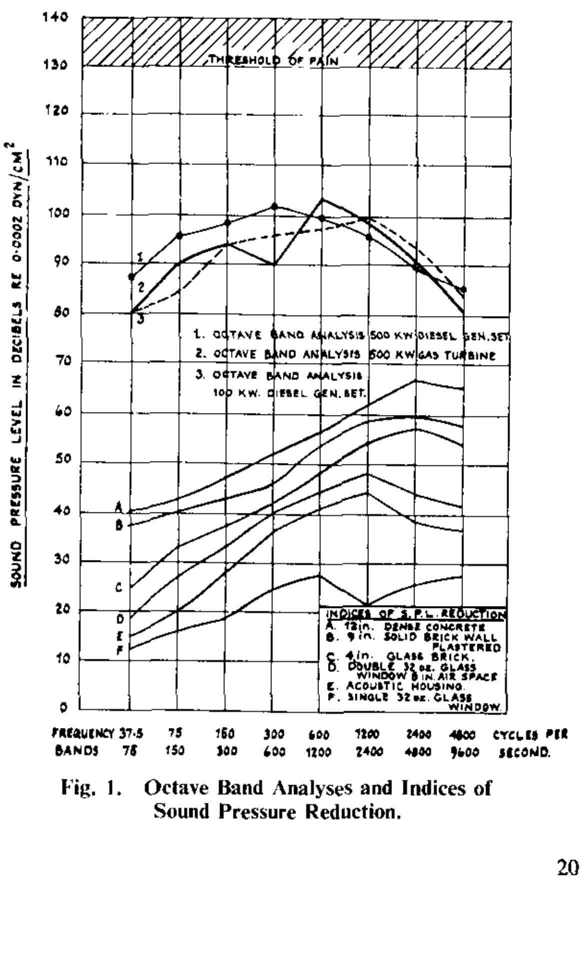

Fig. 1. Octave Band Analyses and Indices of Sound Pressure Reduction.

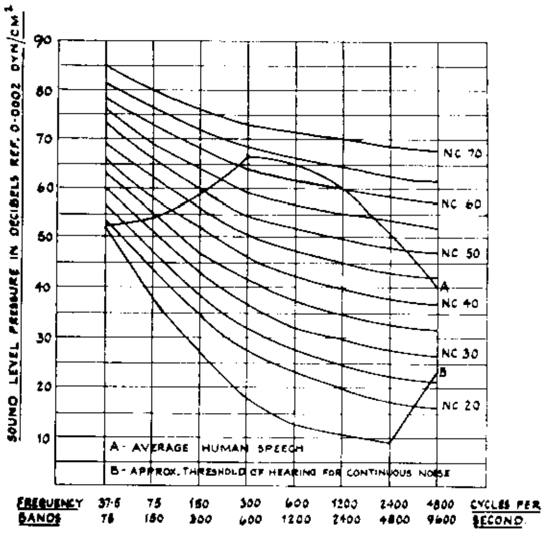

Fig. 2. Noise criterion curves.

Whilst many parts of a hospital building would find this noise level acceptable, a very real problem exists where, for example, a diesel generating set is installed in a power room immediately below an operating theatre. In such a case, sound pressure levels complying with, for example, NC:45 would not be acceptable. Doubling the thickness of the walls and ceiling would reduce S.P.L. by an average of only 5 dB. Lining the walls and ceiling of the power room with sound absorption tiling would reduce S.P.L. by 3 to 10 dB according to frequency.

The best solution in this case is to effect noise control by an acoustic housing built around the generating plant with air inlet and outlet silencers. This can be designed to produce a sound level within the power room complying, for example, with NC:65. Thus, within the operating theatre immediately above such a power room, provided the ceiling consisted of a minimum of 7 inches of dense concrete, the generating set noise would be heard as a background murmur of very low intensity which would not cause disturbance to theatre staff.

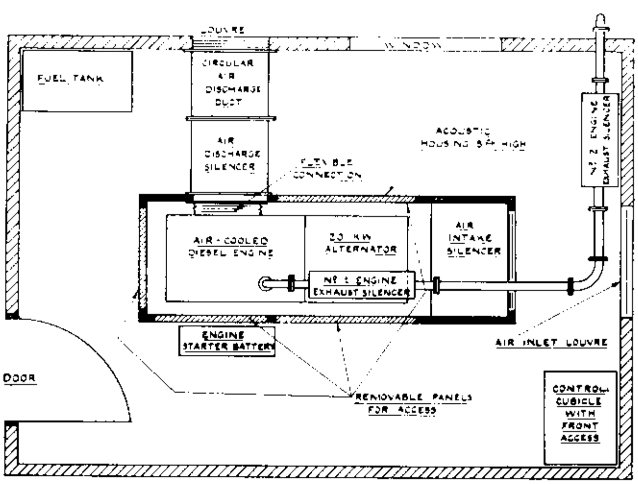

Fig. 3. Power Room layout—Silenced Diesel Generator.

Where the generating plant is not sited on a basement floor, however, this method will not prevent noise from reaching rooms immediately below the plant room. To achieve maximum benefit from noise control in such a case, the plant and acoustic housing must be mounted upon a concrete pad which itself is supported by, for example, studded rubber as a means to isolate the floor from direct contact with air-borne noise from within the housing. This is only necessary of course where an extremely low noise level is required in the room immediately below and where the S.P.L. transmission losses through the floor are not in themselves considered sufficient.

This arrangement is illustrated in Figure 3. Any ducting connected between the air discharge silencer and the air outlet louvre should be preferably of circular cross-section suitable to carry a high velocity air flow without excess vibration. If square or rectangular sectioned ducts are used, these must be stiffened. Engine starter batteries or control batteries should never be accommodated inside acoustic housings since the high air speed causes rapid evaporation of water from the electrolyte.

The prime concern in most hospital installations is transmission of air-borne noise from the power room to nearby buildings.

In designing for noise control of a power installation, the distance of the nearest building from the emergency power room must be considered. It was stated earlier that the inverse square law brings about a 6 dB reduction in sound pressure level for each doubling of distance, but the free field conditions under which this principle applies are not normally encountered on a hospital site and, in practice, this figure is likely to be of the order of 3 to 5 dB depending on distance.

Molecular absorption further reduces sound pressure level depending upon distance, air temperature and humidity. In winter conditions over a distance to 1,000 feet, a reduction of up to 15 dB at 2,400/4,800 c.p.s. may occur, although in summer this figure will be considerably less. Figure 4 is a chart indicating approximate average sound pressure reductions over distance resulting from the combination of molecular absorption, ground attenuation and the inverse square law loss. These figures are conservative and are for guidance only since variations will occur from site to site.

Using this chart, it will be seen, for example, that if a noise level complying with NC:50 is to be achieved outside a hospital building and if the distance from this point to a point, say, 10 feet from the air discharge outlet of a power room is 160 feet, advantage can be taken of the S.P.L. reduction of approximately 20 dB over this distance so that the criterion for noise measured outside the power room need not be less than NC:70, unless extremely adverse site conditions prevail.

Having determined in this way the noise criterion curve

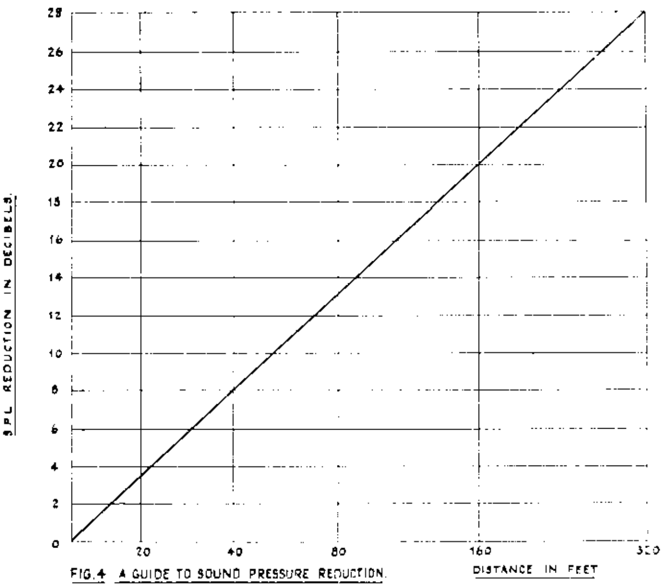

Fig. 4. A guide to sound pressure reduction.

which is to govern the acoustical design of the power installation, it is now necessary to decide upon the method of noise control to be used to prevent excess noise from leaving the power room.

Assuming at all times that the power room building is constructed of materials having good sound insulation properties, attention must be paid to the design of doors and windows which are the weakest points in any building in terms of sound insulation. Doors can be provided to give maximum sound insulation to meet the requirements of such a building, but windows require special attention. Glass bricks should be used wherever possible if natural lighting is required. If this type of window cannot be incorporated, any windows required to light the power room should be double glazed and/or sited on the opposite side of the building from the nearest part of the hospital to be protected from noise; otherwise, it is better for the power room to rely entirely upon artificial lighting.

Whether or not special attention is required to windows depends upon the noise criterion requirement immediately outside the power room. Curves in Figure 1 show the pressure losses through single and double glass windows and through glass brick. If these values are deducted from the curve of the diesel or gas turbine generating set, it can be determined whether or not the resultant is above the design requirements.

Having determined that the walls, floor, ceiling, doors, and windows have adequate insulation properties, it is now only necessary to control the air-borne noise transmitted from the power room through the air inlet and outlet louvres and through the exhaust system.

The engine exhaust noise should be dealt with by the use of balanced primary and secondary silencers which make compliance with NC:60 possible in the immediate vicinity of the tail pipe.

Air-borne noise carried from the power room through inlet and outlet louvres is controlled by the fitting of suitable air silencers which can be designed to suit space limitations in the power room. Figure 5 illustrates this type of power room layout.

The air discharge silencer, wherever possible, should be flexibly connected between the engine radiator and the hot air outlet louvre in the wall of the power room. Where space restriction prevents this, the discharge silencer can be located at a convenient position within the power room without being directly connected to the engine radiator, but with this arrangement the air inlet to the power room must incorporate a silenced fan to produce a pressurised ventilation system.

When the air discharge silencer is directly connected to the engine radiator, the engine driven fan will provide adequate ventilation of the power room provided the total resistance inserted in the ventilation system by the inlet and outlet silencers does not exceed 0.5 inches w.g. If this resistance is exceeded, there will be danger of overheating unless a booster fan is fitted at the air inlet to the power room.

If air inlet or discharge silencers are fitted in a position where rain can enter and saturate the splitter linings, it is important that such linings be protected by perforated or expanded metal. Although water will not reduce the sound absorption properties, the type of adhesive normally used to retain these linings can be seriously affected and the protection is needed to retain them in position when wet.

Although the foregoing remarks have been related primarily to diesel engine driven generating plant, the same principles apply where gas turbines are used as prime movers. In some instances, gas turbine driven stand-

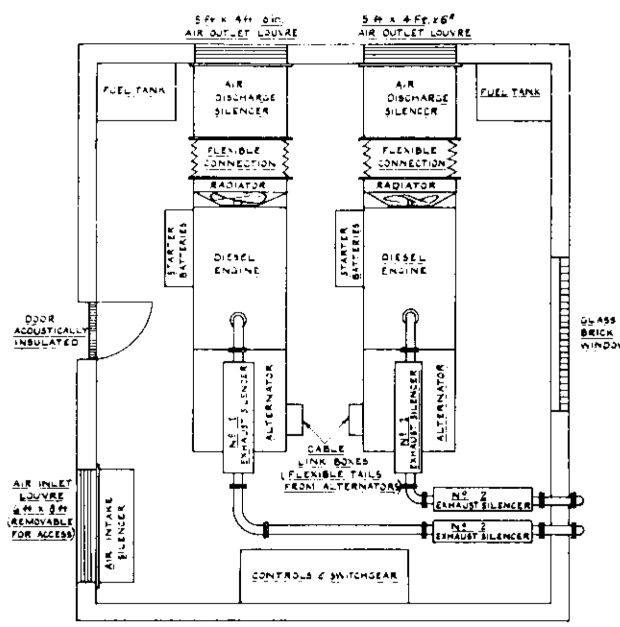

Fig. 5. Silenced Power Room to house two 500 KVA emergency diesel generators.

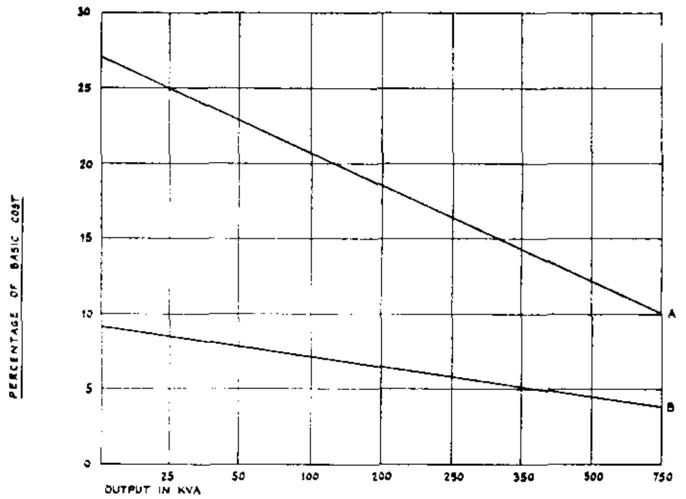

Fig. 6. The Price of Silence: a guide to the approximate additional cost of silencing an emergency generating set.
A — Acoustic housing with air and exhaust silencing as in Fig. 3.
B — Air and exhaust silencing only as in Fig. 5.

by generators present less of a noise problem as rotating and not reciprocating engines are involved. The greatly reduced weight of such an installation enables the plant to be sited upon the upper floor of a building which keeps the exhaust stack as short as possible. As higher frequency sounds are not subject to diffraction, a cone of high frequency noise forms above the exhaust stack and is not radiated about the hospital site. The compactness of gas turbine driven plant reduces the cost of acoustic housings.

The cost of silencing an emergency power installation varies with size but, as a guide, Figure 6 shows the relative cost of silencing expressed as a percentage of the price of an unsilenced installation. It will be seen that the larger the plant, the comparatively less it costs to deal with the silencing problem.

In a short article on the problems of noise control, many generalisations have had to be made to endeavour to give some practical guidance on a complex subject. As conditions will vary from site to site, Austenlite Ltd. may be approached for guidance on specific requirements when required.

In dealing with noise problems, it should never be overlooked that the prime consideration must always be to ensure satisfactory operation of the emergency generating plant.

The Effects of Commissioning on Superintending Engineers

By A. J. MILLIGAN, C.Eng., M.I.Mech.E.
Deputy Regional Engineer, North West Metropolitan R.H.B.

THE title of this paper requires only one to summarise the benefits and say "Yes, commissioning must help the Hospital Engineer, as this will ensure that the equipment installed is functioning exactly as required and with little or no problems during the early days of handover".

Commissioning of engineering services has been discussed by many people and in many institutions. I do not propose, therefore, to go into the details of commissioning, how it should be done or why it should be done; but in this paper will simply analyse the situation leading up to the commissioning stage of any new project, and try to introduce to you the long process and involved discussions that take place before a hospital is finally built and handed over to the team of people who will operate its various functions.

The need for a new development stems from the hospital plan, this dictated on national needs and against national economies; hence finance plays a very important part in the requirements of a building design and service installation. To achieve the maximum benefit, national costs have been calculated basically by averaging previous contract costs throughout the country and up-dating to current trends and increased values. These have to be

A paper read at the I.H.E. Group Engineers' Course, Keele University 1968 maintained in all developments if the scheme is to have an easy flow through the various administration channels. The next link in the chain is the activities of the Project Team. This, and I am perhaps referring more to the activities of my own Region, is in the first instance confined to the various faculties within the Board, who produce schedules of accommodation, requirements special to the particular project, and develop this to a stage which comprises a complete brief on which the project could be designed. This brief and requirements are in association with a cost limit, or target.

During the development of the brief, at the appropriate phase, medical personnel and administrators from the hospital or group concerned join the Project Team and make their contribution to the final design requirements. Once the design brief is agreed, the Engineer and Architect conduct feasibility studies of the siting, shape of the building, type of building, and special requirements for inclusion in the engineering services.

The engineering design for the development would normally be detailed in outline by a senior member of the Regional Engineer's staff. He would have assistance of from five to twenty engineers, depending on the size and scope of the project.

In a discussion such as this one must be practical about the way that design is carried out, and not make excuses for faults but freely admit that faults in installation design do occur. Hence, commissioning and other means of feed-back will in time tend to reduce the deficiencies that one sees time and again in new buildings.

The design brief produced by the Senior Engineer indicates the type of heating, domestic services, electrics required through the various Departments, and, together with typical room layouts or detailed room sheets, the actual number and location of all terminals is clearly given. Areas where it is not so easy to define requirements are those concerned with the method of distribution throughout a project; whether pipes run in specially-constructed ducts or in voids above false ceilings. Each of these has to be analysed on the basis of cost, access for future maintenance and the spread of services required in any particular department solution. Special ducts for services are calculated in size according to the number of pipes, cables, etc., the Design Engineer foresees. The spaces at times appear to be vast, but many times in practice are extremely cramped when all the various services have been installed. The brief and design requirements document, when complete, is passed to the various design engineers to get on with their particular part of the scheme.

The point I am wishing to make here is that the Senior Engineer in charge of the project knows the overall concept he wants to incorporate, but he has to delegate to other, perhaps younger and less experienced designers, and this applies equally well to the architects; and it is in this area where possibly "changes" are made and access and space for equipment is not as one would desire. The reason for bringing this particular point out at this time is to explain that commissioning will not rectify design faults. Commissioning will record design omissions, and will only ensure that the design intent has been followed correctly and check that the equipment functions as it should.

During the whole of the design stage of the project there is a continual refining of the building and engineering details, together with a cost check—sometimes referred to as cost planning. This is, again, to ensure that the full requirements of the Department are met and are still contained within the cost limit for which it is to be built. In many cases compromises have to be reached between the structure, aesthetics and engineering installations, all of which the User or Hospital Engineer will have experienced, and possibly have very definite thoughts on. Again, commissioning will not alter these decisions, but may help in producing a more satisfactory solution in a later project.

On completion of the design and the contract documents, contractors are selected, and eventually construction starts. Problems during construction occur in many ways. Unforeseen difficulties on the site, clashing of building tolerances between the various trades, incomplete or incorrect detailing of certain features of the design require engineering services, electrical and mechanical, building finishes and building structures, to be varied, and in many cases compromises are made to enable the progress of the Contract to proceed without any undue or lengthy delays. These difficulties, again, from the User's point of view—particularly the Maintenance or Hospital Engineer, create life-long problems in the building. Commissioning will not correct these sorts of problems, but helps to bring them home to the Designer as features which should be thoroughly reviewed and developed during the design period.

As the completion of the building programme arrives, so the commissioning phase begins. Then the questions arise: "What is Commissioning?", "Who does Commissioning?" and "What, for the cost involved, does one obtain from a thorough commissioning programme?"

The Design Team require to know that the equipment is correctly installed and functioning as intended. The User wants to know when the plant is complete, how and why it works. These are two entirely distinct functions; from the User point of view one must term commissioning as the hand-over and introduction to the equipment, together with sufficient instruction to ensure that he knows how the plant functions, why it functions, and the intricate details that must become every-day knowledge if the plant is to be maintained in a first-class working condition. The term "Hand-over" is an entirely separate function, and should not be introduced into these discussions, which will be confined to the commissioning phase only, ensuring that the installation is complete.

Following the chain of events leading to the completion of a new project, the Design Team responsible for the building content and the contract supervision, the Contractor responsible for installation, and the Site Supervisory Staff, have all been involved in the various problems leading to the final completion. Are these the right people to be responsible for commissioning? At this stage one can now say that the User has a great interest in the completed project, but each and every one of these people has vested interest in the completed project.

The Designer is interested to see that his early thoughts, calculations and foresight are correct, but he would also perhaps not admit these are deficient, or that his judgement was not as good as it might have been on any particular part.

The Contractor, likewise, has a vested interest in the completed design. He, working for a profit, might take short cuts on the installation which have been overlooked, or where the specification has not been fully implemented. Again, these may tend to be covered up during the commissioning stage.

And finally, the Site Supervisory Staff and the User all have a similar interest where they may not fully record their observations on the installation, or, in the case of the User, may tend to criticise a design in relation to his own way of thinking of how the installation and plant should have been installed.

This leads to one final conclusion: that Commissioning must be done by an experienced individual who had no interest at the design stage of the particular project.

Papers have been prepared and lectures given by a number of people who are fully convinced that Commissioning, if correctly carried out, will greatly assist the User of the completed project. They have suggested that an Engineer specially trained for commissioning is needed. To assist such an Engineer, commissioning manuals have been published. These are at present rather large, bulky documents, and appear to be very laborious and inconclusive in the information produced, but, as a first guide to commissioning, these documents are being applied to current developments. The theme of a Commissioning Manual is to record various questions, tests, checks, etc., which cover a complete development, and which, when filled in by the Engineer commissioning the plant, will help the Designer and User alike; the User by correcting incorrectly installed malfunctioning equipment, and the Designer by feeding back information which might be used on future designs.

The present commissioning documents, as experience is gained, will be refined to be more precise and direct regarding detail-checking and inspection. Unfortunately, neither public organisations nor industry have documented the procedures to be carried out; hence those produced by the Health Service are the first, and of necessity are comprehensive. The commissioning manual is broken down into three main parts: Section I, which is filled in by the Design Engineer, indicates his intent on the design of the project and what he is trying to achieve. The second part, to be completed by the site organisation, simply records the equipment as it is installed, and any changes that might take place. The third and final section is the commissioning document, in which the Commissioning Engineer, against the recorded installation data, checks or records the function called for to make certain that the equipment is right and operating as it should be. This check is against the basic information provided by the Design Engineer, and would incorporate a report regarding malfunction or incomplete installation by the Contractor, and record that the corrections have been carried out, and that the equipment is finally operating in the desired manner.

APPENDIX "A"

COMMISSIONING RECORD

The tabular matter below are typical of sheets from each section of the boiler house commissioning manual, which in total comprises 155 pages and contains approximately 500 questions.

The preliminary section details the plant to be installed and the anticipated operational efficiency, etc., when fired with fuels of a specified grade under certain conditions of operation. This section will be filled in by the Design Engineer and will also form an extremely useful record for the Group Engineer of the type of equipment in each and every installation, its operating characteristics and fuel requirements.

The second section covers examinations before testing. This part of the document is completed by the Contract Supervisory Staff and ensures that the correct materials have been provided as this is filled in at time of delivery and prior to the erection of the various components. This information is basically that used in Planned Maintenance Schedules; hence much of the documentation will have been completed by the Contract Staff, enabling the Group Engineers to quickly complete Maintenance details and Programmes. Other instructions in this particular section ensure that the boiler is correctly charged and in such condition that it will fire and achieve stability duties detailed in Section I.

The final section is the period of commissioning covering the tests and examinations carried out on the plant under operating conditions. This section proves the action of the plant, the operation of the various components, and later questions in

MODERN BRITISH OPERATING THEATRES EXHIBITION AT KING'S FUND HOSPITAL CENTRE

An exhibition illustrating the progress made in design, construction and equipment of British operating theatres will open at the King's Fund Hospital Centre, 24, Nutford Place, London, W.1, on Monday, 23rd September.

Since the start of the National Health Service 700 operating theatres have been provided in our hospitals. The exhibition includes plans of four theatres already built, ten being planned or constructed, and a display by the Ministry of Health of current trends in design.

The plans and equipment on show have been selected as representative of some solutions put forward to answer the many problems involved in providing the best possible conditions for patients and staff in operating theatres.

The exhibition will be open from 9.30 am to 5.30 pm, Monday to Friday, until Friday, 20th December.

this section will indicate the characteristics of the plant after the period of test, giving the Engineer an indication of its operational characteristics, service and maintenance requirements.

Commissioning Detail for Typical Boiler Plant
PRELIMINARIES

4.1.1. DESIGN INTENT
This Section to be Completed by the Engineer. (Boiler Plant)

a. Individual unit output M.C.R. (Maximum Continuous Rating)	3 at 20,000 1 at 10,000	lbs. per hour from and at 212°F.
b. Total plant output M.C.R.	70,000	lbs. per hour from and at 212°F.
c. Overall efficiency I. Winter Load II. Summer Load	 I. 85% II. 75%	
d. Fuel Details: I. Type II. Grading III. Calorific value IV. Ash V. Moisture Content VI. Sulphur Content	 I. Oil II. 3,500 Sec. III. 18,570 IV. ·04 V. ·05 VI. 2·59	 B.T.U.'s per lb. " " "
e. Feed water temperature	180°F.	

EXAMINATION BEFORE TESTING
4.2.2. BOILER (Sheet 1 of 3)

CHECK: a. Number plates and maker's nameplates are fitted and details clearly marked according to duty and specification	No. 23168/68 Manufacture "Y" Boilers Ltd. Duty 20,000 lbs./hr. from and at 212°F. Working Pressure 100 p.s.i.
b. Levels across boiler for adequate fall and drainages to blow-down	4″
c. Nozzles or tubes used for removal of soot and dirt are correctly aligned and unlikely to impinge upon parts of boilers	Nil
d. Internal and external surfaces for damage, pitting or corrosion	Checked—O.K.
e. Loose objects or foreign matter are not present	Boiler Clean
f. Seals or packing at points where air or gas leakage is liable to occur are sound and well fitting	Tight—required checking when boiler is fired
g. Sample of boiler water tested to ensure correct conditions at start-up	Correct

TESTS AND EXAMINATION DURING TESTING
4.3.2. BOILERS (Sheet 1 of 3)

CHECK: a. Recorder details are logged at start of test	Water 001 Oil 0003 } checked Electricity 1234
b. Water level of boiler and log	Full Log correct
c. Water level of measuring tank and log	Full to level mark Log correct
d. Ash-pit has been properly cleaned and doors sealed	Clear
e. Fuel being used is that specified. Where different from 4.1.1.(d) show details	As per design
f. Dust collection equipment fitted is empty	Clear
g. With manometer that dampers operate correctly and note draught readings at various settings including fully closed	Checked Closed ·001″ full open 2″
h. Operation and readings of smoke indicating and alarm equipment using either Ringelmann Charts or similar as check	
i. CO_2 recorder and/or indicator, using Orsat or similar apparatus	
j. Each hour by calculation, the dry gas loss using method outlined in notes 74 and 75 of B.S. 845:1961	
k. By quick adjustment of damper, brickwork for puffs of gas as check on brickwork tightness	
l. Tightness of brickwork tie-rods	
m. At maximum load for priming and foaming, also that this is not affecting wetness of steam to grate cooling system, or steam atomised oil burners	
n. Tightness of securing nuts of manholes or any other access covers of pressure space	
o. Accuracy of automatic feed water controls	
p. Operation of water level gauge glass cocks, comment upon I. Accessibility II. Visibility from firing floor III. Safety of blow-down discharge points	 I II III

Abstract of Reports

BURNLEY AND DISTRICT H.M.C.

The 19th Annual Report of the Committee covers the year ending 31st March, 1968. The challenge to the Committee to encourage people to consider themselves as one community and look forward to the development of their District General Hospital.

The country's financial state has, unfortunately, not improved since the last Report and the effect of devaluation has increased the cost of the Service for which there has not been a corresponding increase in the revenue allocation. The Committee, however, were very thankful to know that the Capital Building Programme was not affected when the Government found it necessary to make a number of substantial cuts in Departmental spending.

The Committee were extremely disappointed by the delay in the completion of Phase I of the major development in the Group, the new Maternity Unit and the Kitchen and Staff Dining Room.

The Minister of Health had decided to accept the recommendations of the Manchester Regional Hospital Board regarding the revision in maternity services in this area when the new Edith Watson Maternity Unit is available.

Capital Works Programme

The Committee had hoped to see the completion of Phase I of the Major Development Scheme at the Burnley General Hospital by the end of the year but, unfortunately, the Contractors had not kept pace with the agreed programme of work, and there is still a considerable amount of interior work to be undertaken. Although the Ante-Natal Clinic is to be handed over to the Committee on the 22nd April, 1968, it will have to be used for the storage of equipment for the major block until other accommodation is available.

Whilst there are no plans for the alternative use of the Fern Lea and Christiana Hartley Maternity Homes, the present intention is that the Bank Hall Maternity Hospital will be converted for use as a Geriatric Assessment Unit of 42 beds. This proposal is at present open to review in the light of information which it is hoped will soon be available on the way in which certain road developments proposed to be carried out in the vicinity of the hospital will affect the use of this building for hospital purposes.

The new residential accommodation for midwifery staff and the four new flats for the medical staff were completed in June and October respectively.

Discussions have continued with the Regional Board on the basic proposals for Phase II of the development of the Burnley General Hospital as the District General Hospital and draft proposals have now been submitted to the Ministry. This phase, which is scheduled to commence in 1969/70, will include a new Out-Patient Department and X-Ray and Physiotherapy Departments and the Committee have also pressed for the inclusion of a new Accident and Emergency Department in the scheme.

Several meetings have been held with the Officers of the Board on the plans of the proposed Intensive Care Unit at the Burnley General Hospital and the Board have now agreed to include a two bedded Renal Unit in this scheme. It is hoped that a start will be made on this scheme in August, 1968. The accommodation is to be designed so that a coronary observation unit can be added at some future date.

The following schemes of improvement and development were completed during the year—

Burnley General Hospital

Residential accommodation for medical staff (four flats).
Improvements to Plant Room.
Extension to Pharmacy.

Victoria Hospital

Installation of piped oxygen.
Conversion of the former Pathology Laboratory for use as a Group Medical Records Department.

Marsden Hospital

Provision of new boilerhouse and heating services.
Installation of piped oxygen.
Upgrading of Nurses' Home.

Reedyford Memorial Hospital

Phase II of the repairs to the outside fabric.

Burnley General Hospital.

Upgrading of heating services.

At the close of the year the following schemes, in addition to the major development, were in progress or likely to be commenced in the very near future —

Burnley General Hospital

Intensive Care Unit.

Victoria Hospital

Provision of Day Rooms for Medical Wards.
Radiological Safety precautions in X-Ray Department.

The new Pathology Laboratory was officially opened by Professor A. C. P. Campbell, Professor of Pathology, University of Manchester on the 1st June, 1967.

The Laboratory is now able to provide a full Cervical Cytology Screening Service for the population within the Committee's catchment area.

The demands made upon the Department continue to increase and the stage has been reached when any further increase in volume of work undertaken can only be achieved by automation. A second line auto-analyser has been installed in the Biochemistry Section and an automatic platelet counter has been provided for the Haematology Section.

X-Ray Service

The work of the department has continued to increase gradually and equipment has been modernised to meet this demand.

The X-ray equipment at the Burnley General Hospital has been replaced by a Zenith 404 unit costing £11,000, designed and installed by A. E. Dean & Co., Croydon. The X-ray couch is of new design and is to the requirements of the Consultant Radiologists.

New mobile equipment has also been made available for ward and theatre use at the Victoria Hospital.

The third X-ray room used for minor casualties at the Victoria Hospital was due for upgrading to comply with radiation protection standards. This scheme was originally scheduled to be undertaken in 1968/69, but the work has been brought forward and is now in progress.

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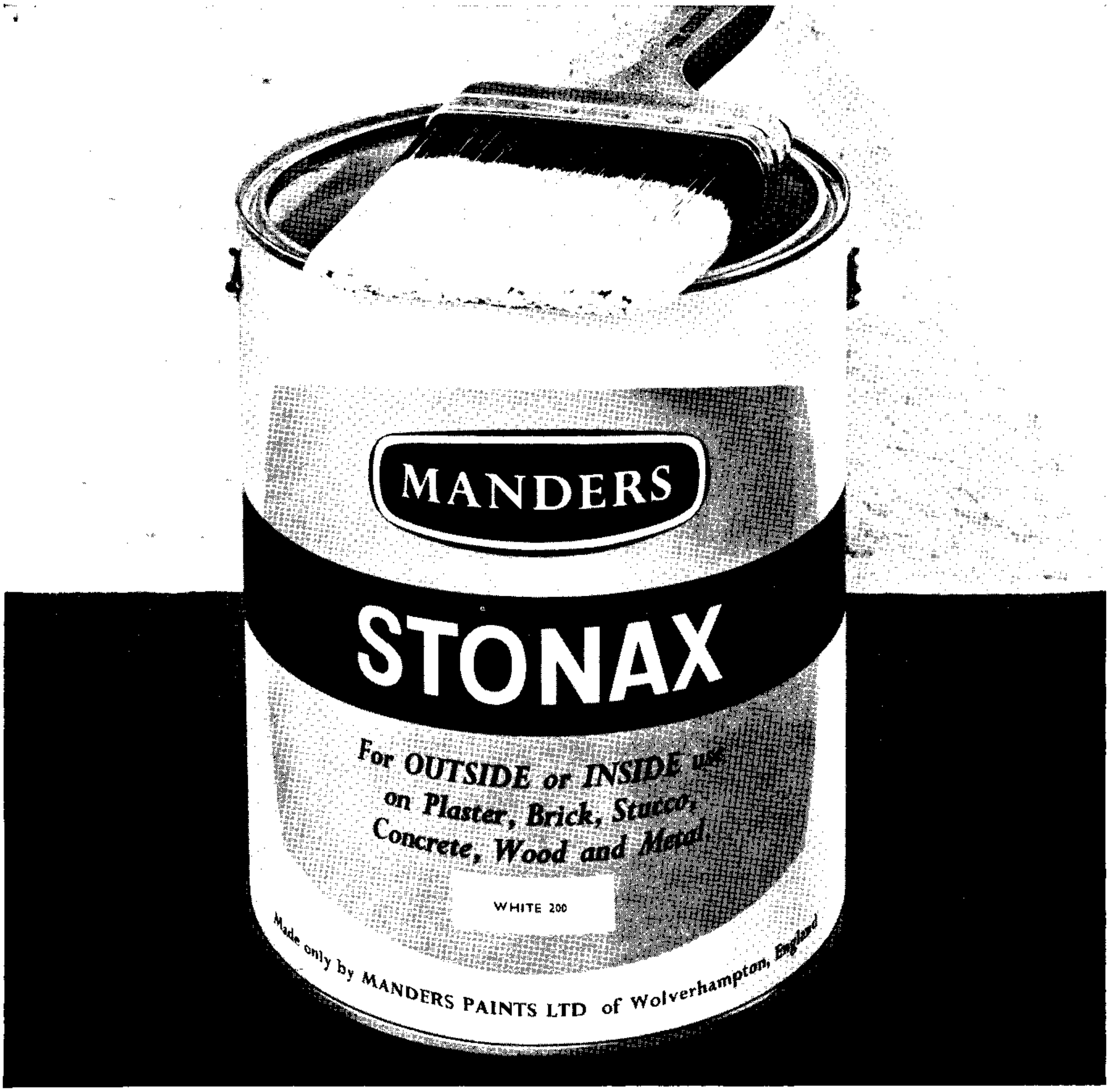

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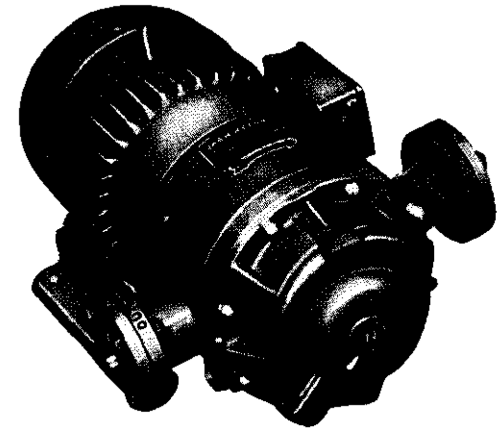

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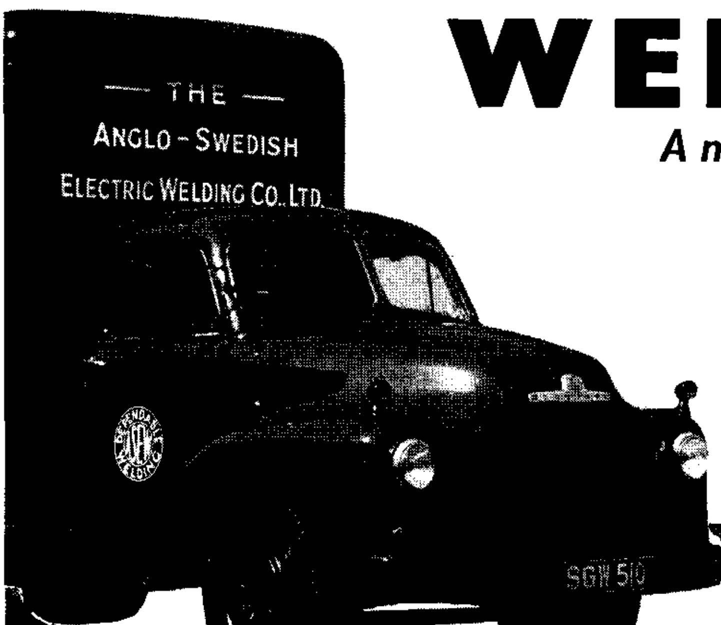

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Cardiological Service

A supplement to the equipment of the Department has been the provision of a Vitalograph machine which will be used for the measurement of pulmonary function.

Pharmaceutical Service

The minor capital scheme approved by the Regional Board for an extension of the Group Pharmacy at the Burnley General Hospital at a cost of £8,000 has been completed and provides improved accommodation for in-patient and out-patient work and also much needed extra storage facilities. One of the main advantages is that it will separate the manufacturing departments from those concerned with issues and receipts.

The Aberdeen System of drug distribution has been introduced as a pilot scheme on one ward at the Burnley General Hospital and has been enthusiastically received and operated by the medical and nursing staff.

Works Maintenance and Engineering Services

In addition to the major capital works being undertaken in the Group, a great deal of work is done by the Engineering and Works Departments on the maintenance of existing buildings and services and in the execution of smaller schemes of improvement, extension and adaptation.

The Committee have approved a scheme for the introduction of a Planned Maintenance Programme for the electrical and mechanical services at the Burnley General and Marsden Hospitals which provides for a programmed inspection and maintenance of all the equipment, machinery, etc., and will involve the appointment of two Fitters, one Plumber, three Electricians and three Assistant Engineers. Arrangements have also been made to deal with the increased amount of electro-medical equipment in the hospitals by the upgrading of Mr. K. Hopwood, Electrician, who will now be available to assist Mr. H. Ormerod, the Assistant Engineer in charge of the maintenance of this specialised equipment.

It is also intended to draw up a scheme of planned building maintenance to provide a regular programme of painting, decorating and wall washing throughout the Group.

Central Laundry

The Pooled Linen System introduced last year for a large selection of items has now been extended to all the hospitals in the group. After some minor "teething" problems in the initial stages, the system appears to be working satisfactorily and the hospitals are being provided with a better service.

The output of the Laundry continues to increase, the average weekly figure now being approximately 65,000 pieces and it is anticipated that the opening of the new Maternity Unit at the Burnley General Hospital will bring about a sizeable increase.

B.S.I. News

Abstracts of information supplied by the British Standards Institution

NEW BRITISH STANDARDS

B.S. 476: Fire tests on building materials and structures 476: Part 5: 1968 Ignitability test for materials 5s.

A preliminary test to determine primarily the behaviour of materials in sheet or slab form when subjected to a small flame. (SBN: 580 00216 0)

B.S. 476: Part 6: 1968 Fire propagation test for materials 6s.

Compares the contributions of combustible building materials to the growth of fire.

B.S. 3999: Methods of measuring the performance of domestic electrical appliances 3995: Part 5: 1968 Electric Cookers 15s.

Principal performance characteristics of interest to the users of domestic electric cookers. Applies to cookers with a rated input of not less than 3kw. Does not apply to cookers used for commercial catering. The Consumer Council will use this standard for its Teltag scheme. Supersedes B.S. 1315. (SBN: 580 00084 2) The shade chart for the assessment of browning, included in the standard, is also available separately in the form of a shade chart and a shade gauge, as follows:

B.S. 3999: Part 5C: 1968 Shade chart 3s.

B.S. 3999: Part 5G: 1968 Shade gauge 10s.

B.S. 4323: 1968 Method for the estimation of dimensional change induced by a free-steam vacuum garment press 5s.

Estimates, by simulation, the recovery from latent manufacturing strains of woven and knitted fabrics. (SBN: 580 00224 1).

REVISED BRITISH STANDARDS

B.S. 161: 1968 240 V Tungsten filament general service electric lamps 10s.

Tungsten filament lamps for general lighting service on 240 V. supplies. Dimensions of "fittings free space" requirements. Type test for lamp cap temperature rise. (SBN: 580 00226 8).

Supplement No. 1: 1968 to B.S. 192: 1961 Open-ended spanners 3s.

Provides information about basic across flats spanner sizes necessary for use with ISO metric fasteners. Suggested size combinations for double-ended spanners have been included to provide guidance on possible future developments. (SBN: 580 00235 7).

B.S. 747: 1968 Roofing felts 10s.

Specifies roofing felts intended for use in the British Isles and in countries having a similar climate. (SBN: 580 00219 5).

B.S. 1846: Glossary of terms relating to solid fuel burning equipment 1846: Part 2: 1968 Industrial water heating and steam raising installations 8s.

Deals with terms relating to solid fuel burning installations supplying hot water or steam, including those fired with pulverised fuel. (SBN: 580 00227 6).

Supplement No. 1: 1968 to B.S. 2558: 1954 Tubular box spanners 3s.

Provides information about basic across flats spanner sizes necessary for use with ISO metric fasteners. Suggested size combinations for double-ended spanners having been included to provide guidance on possible future developments. (SBN: 580 00236 5).

Supplement No. 1: 1968 to B.S. 3555: 1962 Ring spanners 3s.

Provides information about basic across flats spanner sizes necessary for use with ISO metric fasteners. Suggested size combinations for double-ended spanners have been included to provide guidance on possible future developments. (SBN: 580 00237 3).

Supplement No. 1: 1968 to B.S. 4006: 1966 Socket spanners 3s.

Provides information about basic across flats spanner sizes necessary for use with ISO metric fasteners. (SBN: 580 00238 1).

REVISED CODE OF PRACTICE

CP 144: Roof coverings: CP 144: Part 1: 1968 Built-up bitumen felt 10s.

Deals with use of bitumen roofing felts conforming to B.S. 747. Sets down requirements for materials, design and construction of roofs and preparation of surfaces both flat and pitched on which built-up roofing is to be laid and gives general recommendations to ensure a satisfactory roofing covering. Roofing details are illustrated. (SBN: 580 00220 8).

AMENDMENT SLIPS

	Ref. No.
B.S. 65 and 540: 1966 Clay drain and sewer pipes including surface water pipes and fittings. Amendment No. 1	PD 6410
B.S. 459: Wooden doors. 459: Part 2: 1962 Flush doors. Amendment No. 3	PD 6375
B.S. 497: 1967 Cast manhole covers, road gully gratings and frames for drainage purposes. Amendment No. 1	PD 6398
B.S. 864: 1953 Capillary and compression fittings of copper and copper alloy for use with copper tube complying with B.S. 659 and B.S. 1386. Amendment No. 4	PD 6411
B.S. 1186: Quality of timber and workmanship in joinery .1186: Part 2: 1955 Quality of workmanship. Amendment No. 4	PD 6397
B.S. 1191: Gypsum building plasters. 1191: Part 2: 1967 Premixed lightweight plasters. Amendment No. 1	PD 6400
B.S. 1500: Fusion welded pressure vessels for general purposes. 1500A: 1960 Extract from B.S. 1500: Part 1: 1958. Amendment No. 3	PD 6387
B.S. 1740: 1965 Wrought pipe fittings, iron and steel (screwed B.S.P. thread). Amendment No. 1	PD 6408
B.S. 2050: 1961 Electrical resistance of conductive and anti-static products made from flexible polymeric material. Amendment No. 3	PD 6208

BASIC METRIC SIZES FOR ENGINEERING

A British Standard which is important in the change to metric in the U.K. engineering industry has now been published—B.S. 4318 *Preferred metric basic sizes for engineering*—prepared by B.S.I. after an extensive survey of existing usage of basic sizes in metric countries.

In the absence of I.S.O. (International Organisation for Standardisation) Recommendations on this subject, the new standard has been based on national standards and EURONORMS for materials.

During the development of B.S. 4318 reference was made to I.S.O. Recommendations on preferred numbers but it was concluded that, while series of preferred numbers are important as a guide to the rational selection of ranges of values for the functional parameters of designs, they are not necessarily appropriate as series of linear sizes for detailed engineering design work.

The standard therefore contains a recommended list of preferred metric basic sizes from 1 millimetre to 300 millimetres and guidance is given on the choice of sizes larger than 300 millimetres. The series shown are based on the following three main considerations.

First. Convenient simple numbers are preferable because of the resulting simplification of product design and manufacture.

Second. It is frequently necessary to use ranges of sizes having small, or relatively small, but constant increments. In such cases the use of a geometric series has no practical merit.

Third. A series of linear basic sizes for design use should be commensurate with standardised or commonly available sizes of semi-finished materials, small tools, threaded fasteners, etc.

In the light of B.S.I.'s investigations it is considered that the series presented in this standard represents the most rational practice for British industry in adopting the metric system and it is hoped that its publication will serve to stimulate further effort towards international agreement on this subject.

The provisions of the standard are not, however, intended to override the choice of sizes given in current British Standards which comply with I.S.O. Recommendations and other international agreements.

(B.S. 4318, price 5s.)

RETREADED TYRES

Statistics show that faulty tyres are a prime cause of a large number of accidents involving road vehicles, and the fact that there has been some adverse criticism of retreaded and remoulded tyres shows the need for a measure of control on their processing.

In view of the recent Ministry of Transport Regulations which make it an offence to use on the roads tyres with treads worn beyond prescribed limits, damaged casings, recut treads and other unsuitable types, a new British Standard in the automobile series, B.S. AU 144 *Retreaded car and commercial vehicle tyres*, will be of interest.

This standard, prepared at the request of the Ministry of Transport, concentrates mainly on the examination and preparation of the old tyre before processing, and gives limits of acceptable damage. Details of suitable rubber compounds are included.

The standard covers retreading, recapping and remoulding, and it is a requirement that tyres shall be so processed that they are suitable for prescribed road speeds for different types.

Tyres which comply with this British Standard must be marked with the specification number: "B.S. AU 144" and the word "RETREAD" or "REMOULD".

It is understood that the Ministry is considering implementing the standard by legislation; such action would go a long way towards eliminating unsatisfactory retreads.

It cannot be too strongly emphasised, however, that the vehicle user, also, has a responsibility in reducing road accidents. No matter how good his tyres, new or retreaded, they must be maintained to ensure correct inflation pressures for the loads and speeds recommended by the makers—particularly important in these days of increasingly high speeds. Tyres must be examined regularly for signs of damage and tread wear and renewed as soon as they become unserviceable.

On the Market

A review of new equipment and materials and their development

NEW EMERGENCY LIGHTS SAVE INSTALLATION COSTS

Two new self-contained emergency lighting units have been marketed by **Accessories Electrical Supplies Ltd.,** 118-128 High Road, London, N.15. Incorporating Voltabloc nickel-cadmium batteries and automatic charges, they need no maintenance, and appreciable savings, it is said, can be made in installation costs as they can be connected to the normal mains circuit, a separate low-voltage circuit being unnecessary.

The TL7 unit is a 7-in. diameter ceiling-fitting unit with one 15W mains-voltage bulb. If a mains failure occurs, two 3·6V 1A bulbs are automatically illuminated by battery current and will remain energised for approximately 1½ hr. When mains current is restored, the battery is recharged by the inbuilt charger.

Two-thirds of battery capacity, sufficient to provide an hour's emergency illumination, is recovered after a day's recharging.

A small neon indicator, which is mains-energised when the unit is live, is provided to warn a person who changes the main bulb when necessary. Price of the TL7 is £22 10s.

The other unit is the EL12. This is a rectangular wall fitting with a reeded acrylic front carrying the words "Emergency exit". The EL12 costs £22 10s.

The Voltabloc batteries used are made by Cadmium Nickel Batteries Ltd.

NEW INDICATING THERMOSTATS

Ward Brooke & Co. Ltd., Loudwater, Nr. High Wycombe, Bucks, are marketing a range of two-step variable indicating thermostats.

The new units combine the features of clear temperature indication and switch setting position with negligible pointer detent when the switch is operated, and close switch differential. The measuring system operates via a liquid filled phial and capillary tube system whereby the pressure necessary to activate the indicating mechanism results from the liquid's expansion due to temperature variations at the phial—the increased pressure is then transmitted to a bellows expansion unit which converts it into a mechanical force.

Set point setting of the control switch, which is indicated on a separate scale, is provided by a simple cam mechanism. Two independent micro-switches, capable of being set over the entire operating range, are normally built-in to these indicating thermostats and are rated at 10A, 125, 250, 440 V a.c. or 5A at 125 V d.c., whilst a third factory set switch is rated at 5A, 230 V a.c. and 0·4A, 110 V d.c. Versions with 4 independent switches are available if required. Although switching differentials are kept to an absolute minimum, they are directly dependent upon the type of switch used and larger differentials can be provided by the use of auxiliary switch cams. General purpose micro-switches, high sensitivity switches, and high d.c. capacity magnetic blow out switches are available with minimum switch differentials of 1¼%, 2½% and 7%, respectively.

The new indicating thermostat range comprises a number of models with temperature ranges varying from −100 to +200°F. (−80 to +40°C.) to 300 to 560°F. (150 to 300°C.) and capillary tube lengths of 40 ft. for temperatures u pto 320°F. (160°C.) or 10 ft. for temperatures up to 560°F. (300°C.). Both flush and surface mounting types are available.

NEW EVAPORATOR THERMOSTAT FROM DANFOSS

Danfoss (London) Ltd., 6 Wadsworth Road, Perivale, Middlesex, announce the introduction of their type 090B3 evaporator thermostat which is used for the control of compressors in freezers and similar equipment.

A main switch on the unit makes circuit on a rise in temperature, whilst a signalling switch, which is of the changeover (SPDT) type, is activated if the temperature at the bulb on the capillary tube increases to a predetermined value above the main switch cut-in temperature.

The Danfoss type 090B3 thermostat is available with a cut-out range of 13/27°F. (7/15°C.) within an overall temperature range of approximately −31/5°F. (−35/−15°C.) with differentials of between 7·2°F. (4°C.) and 21·6°F. (12°C.) approximately, depending on the temperature range. The signalling temperature is normally adjusted to between approximately 3·6°F. (2°C.) and 18°F. (10°C.) higher than the main switch cut-in temperature.

Within limits, the thermostat can be supplied with any lengh of capillary tube, although the standard units are available with tube lengths ·8 or 1·2 m. (31 or 48 ins.). Electrical ratings are 6A, 250 V a.c. (main switch) and 1A, 250 V a.c. and 0·1A, 250 V d.c. (signalling switch).

The type 090B3—a new unit within the Danfoss 090 series of thermostats—has been incorporated in the Danfoss standard programme and will eventually supersede the current 50E series.

TEMPERATURE RECORDER/ALARM FOR BLOOD BANKS

Instant audible warning of dangerous variation in the temperature of blood bank storage units is provided by **British Rototherm's** new recorder/alarm. In addition to giving warning of temperature rise or fall, the recorder has a relay which operates the alarm in the event of mains electric supply failure.

The instrument—Model 06621/1—is mercury-in-steel operated. It has a 6 in. disc chart marked with a green band emphasizing the "safety" zone between 2·2°C and 7·86C. Two fixed electric contacts provide an alarm signal on a 4½ volt buzzer if the temperature varies outside these limits. The special battery-operated relay is built into the case to operate the alarm in the event of mains supply failure. Extension terminals for remote alarm indication are provided and a switch for manual testing of the alarm circuit is included.

The recorder case is of die-cast aluminium alloy, suitable for panel mounting; wall mounting can be provided. The 6 in. chart is ranged from minus 10°C. to 50°C. with a seven-day rotation period, operated by a spring-wound clock. The pen is of the capillary type, fed from a reservior clipped inside the case lid.

A 10 ft. copper sheathed stainless steel capillary is fitted as standard, with an 8 in. by $\frac{3}{4}$ in. diameter stainless steel bulb.

The price of Model 06621/1 is £58 0s. 0d. and delivery is eight weeks.

A model with a 10 in. disc chart is already in the company's range, and their address is Merton Abbey, London, S.W.19.

120 kW MOBILE SILENT GENERATORS

A new type of silent generator, that combines extreme mobility with high power capacity and is sound proofed to reduce the noise level of the diesel engine down to 55 decibels, is introduced by **G & M Power Plant Co. Ltd.**, Whitehouse Road, Ipswich.

The generator, developed by Scania-Vabis Ltd., is considered to be of particular interest to hospitals and those who are required to provide emergency supplies to areas where power failure has occurred. Inaudible at 50 feet, the generator is the complete answer for operation at night in built up residential areas.

Designed specifically to the requirements of G & M Power Plant, the generator employs as its prime mover a Scania-Vabis DSI-II six cylinder, turbo-charged, radiator cooled diesel engine giving a rating of 191 B.H.P. at 1,500 r.p.m. This is coupled to either A.C. alternators or D.C. generators of British manufacture. The output is 120 kW.

An acoustic insulated cabinet reduces diesel engine noise down to 55db in the 500 to 1,000 cycles frequency range and the four large doors can be fully opened out to give complete accessibility for routine maintenance and servicing.

The generator has a high power to weight ratio, weighing only 5·3 tons complete with its sound proof cabinet. The unit can be easily mounted on any six to seven ton lorry chassis to provide a highly mobile emergency source.

Overall dimensions of the unit are 157·2 in. long, 78·7 in. high and 96·5 in. wide.

MAJESTIC INCINERATOR WILL BE SOLD BY SOUTHALLS

The new Majestic 23 electric incinerator, introduced by Osborn Manufacturing Company Ltd., will now also be marketed in this country by **Southalls (Birmingham) Ltd.**, of Birmingham.

The Majestic, with a capacity of 2·3 cubic feet, will be the biggest machine in Southalls' comprehensive range of gas and electric incinerators. The incinerator will be known as the Southalls Majestic, and will also continue to be sold and serviced by Osborn under the name Cobra Majestic.

The Majestic has some unique features, including a fool-proof double burning element and a turbo chamber which burns the smoke before it enters the flue pipe.

NEW FAN HEATERS FROM 'XPELAIR'

One of the two Fan heaters available from **Xpelair Ltd.**, the ventilation fan manufacturers of Colchester, Essex, is a new unit capable of carrying out the work previously handled by four models.

The 6kW (WH60) replaces the 5kW model which had been marketed in single and three-phase form whilst retaining the same appearance as its predecessor, offers extra performance and covers a single-phase voltage range of 220-250v as well as a three-phase range of 380-440v. The price remains £21 5s. 0d.

The smaller 3kW (WH30) unit features improved appearance and has been modernised. Its price remains at £15 18s. 6d.

Also being introduced by Xpelair this year are new Fan Heater Controllers. More modern and functional in appearance, the controllers can be flush or surface mounted and are available with or without thermostat. HC301 controller with thermostat, price is £6 9s. 9d. HC302 controller without thermostat £1 19s. 0d.

An important safety feature common to both units is the fact that heating elements never exceed black heat; others are incorporated in case of interruption to the air flow.

The 3kW heater circulates 12,000 cubic feet of warmed air per hour with a heat output of 10,000 Btu/h. The 6kW unit circulates 13,800 cubic feet of warm air per hour with a heat output of 20,500 Btu/h.

NEW POLYTHENE BIN LINING

W.C.B. Containers Ltd. can now incorporate an integrally-moulded white lining in their polythene bins. It is important also in all situations where a high standard of hygiene must be maintained.

Some W.C.B. bins have the white lining as a standard feature, while it is available as an optional extra on others. In the range of bins which have an "E" prefix, there are 11 bins which have standard moulded white linings. Capacities range from 5 to 25 gallons, diameters from 11 in. to 20 in. and depths from 9 in. to 30 in. Some are tapered and others are stacking bins. Colours available are natural, mottled grey and blue.

Prices: from 27s. 6d. to 96s., depending on model and quantity ordered. Further details from W.C.B. Containers Ltd., Stamford Works, Bayley Street, Stalybridge, Cheshire.

LIQUID LEVEL GAUGE

Ward Brooke & Co. Ltd., members of the Norcros Group, Loudwater, Nr. High Wycombe, Bucks, are marketing a new range of liquid level gauges which are suitable for use with all non-corrosive liquids including those of flammable or hazardous nature. The new units, which are of the pneumatically operated type and self-contained, provide remote indication of the liquid levels in vented tanks.

The range comprises three basic models, all of which are available in flush and wall mounting types, for hand pump manual or compressed air automatic operation. Model 1 is suitable for use with tanks of from 2 ft.-10 ft. high and has a maximum mounting distance from the tank of 150 ft. for the hand pump model and 1,000 ft. for the automatic constant air model. Model 2 is a medium range, long scale type, which may be used on tanks up to 15 ft. high, whilst Model 3 is capable of measuring tanks up to a maximum of 30 ft. high. All models can be weather-proofed and fitted with switches which give "high/low" warning against the tank overflowing or emptying, and also have built-in specific gravity correctors so that they are adjustable on site to cater for different grades of oil.

Further details of Ward Brooke liquid level gauges, including price and delivery, are available on request to the manufacturers.

VICKERS MARKET NEW RESPIRATION UNIT

Said to be one of the most advanced respirators designed particularly for intensive therapy applications has been introduced to this country by the Medical Group of **Vickers,** U.K. distributors for Puritan-Bennett International Inc.

It is the Bennett MA-1-B volume-limited respirator unit which incorporates an entirely new printed-circuit electronic control system.

Ultra-high efficiency bacteriological filters provide near-sterile gas for the patient and so reduce the dangers of cross-infection, one of the greatest problems arising from the use of patient breathing equipment.

Other features of the MA-1-B include a spirometer showing tidal volume; an elapsed time indicator; an adjustable heated humidifier and a nebuliser for the administration of medicaments.

Vickers Medical Group already act as U.K. distributors for Puritan-Bennett intermittent positive-pressure breathing therapy equipment, anaesthesia assistors and respirators. The Company's address is Vickers House, Millbank Tower, Millbank, London, S.W.1.

NEW ZEISS PHOTOMICROGRAPHIC CAMERAS FOR ALL FORMATS

Carl Zeiss of West Germany have developed a range of photomicrographic equipment which offers suitable attachments for every possible type of photo recording requirement. There are three basic models of camera for attachment to the microscope either by an adapter ring, or camera arm. They house the image-forming objective and take the focusing telescope, used to view and adjust the specimen image while the camera is in position. The back of the body then accepts a variety of film holders or standard camera backs.

The photomicrographic camera attachment model I has a mechanical shutter and incorporates a stationary beam-splitting prism directing 60% of light to the film plane, and 30% to the viewfinding telescope. The model II is similar but has a variable beam splitter which simplifies use of the optional exposure control unit. Third choice of attachment is the fully automatic camera which has a rotary electric shutter with the added advantage of vibrationless operation. Each of the three types of body is available in five sizes to take all roll and plate films from 35 mm. to 5 in. x 4 in.

Standard Polaroid and Linhof camera backs can be used in conjunction with the bodies, and Zeiss Ikon Contarex cameras can be used with nothing more than an adapter.

Selection of the appropriate camera attachment depends on the size of negative, the type of shutter and exposure control required. Small formats are recommended where fluorescent illumination is to be used as shorter exposure times are possible. This range is available for all existing microscopes made by Zeiss Oberkochen.

The Carl Zeiss agents are Degenhardt & Co. Ltd., 20, Mortimer Street, London, W.1.

NEW CEILING MOUNTED AIR CONDITIONERS

A new range of split system air conditioners, named the "Champion", is being marketed by York Division of **Borg-Warner Ltd.,** North Circular Road, London, N.W.2.

Designed for quiet operation and situations where floor space is limited, the "Champion" range comprises ceiling or shelf mounted pre-engineered air handling sections and matching Yorkometic high side equipment for simple copper pipe connection on site.

The compact cooling sections are constructed from sound-proofed fibre glass with removable panels for inspection and adjustment. The units are complete with cooling coils, centrifugal type fans, resiliently mounted specially sized fan motors, expansion valve, steel condensate tray and filter. Operational standard accessories include step-controlled electric heaters, wall mounted thermostats and decorative air distribution plenums.

When fitted with decorative plenum, a Champion air handling section requires no ductwork or floor space for single room air conditioning. For air conditioning more than one room, cooling sections can be installed with ceiling or underfloor supply and return air ducts.

NEW PORTABLE TEMPERATURE RECORDER

The "Thermoscript" temperature chart recorder marketed by **Smiths Industries** is a new, compact, portable, bi-metal instrument which has been designed specifically to meet the problems encountered where temperature measurement is critical. It is eminently suitable for the monitoring of storage or cooling temperatures during transportation and is equally suitable for use in industrial laboratories and the heating and ventilating field.

The instrument, which can be held in the hand, is self contained in a robust case and weighs only 1kg (2·2lb).

Three models are produced, covering the following temperature ranges: 0 to +65°C, −20 to +45°C, and −40 to +25°C. The recording chart is driven by a clockwork movement having thirty two days running time, which provides a choice of three chart speeds, enabling each chart to run for eight, sixteen, or thirty-two days.

The recorded accuracy is better that 1·5% of full scale over the 65 mm. (2·5 in.) chart width. The Company's address is Kelvin House, Wembley Park Drive, Wembley, Middlesex.

Notes for Members

ROTATION OF MEMBERS OF COUNCIL OF THE INSTITUTE

At a Meeting of Council held on 30th July, the rotation of its Members was determined, to comply with Articles 81 and 82. Lots were drawn (Article 82) and the results were as follows:—

General Members	*To retire*
H. A. Adams	1969
K. W. Ashton	1970
M. J. M. Bosley	1971
Nominated Members	
B. A. Hermon	1969
E. J. Eatwell	1970
G. S. Gillard	1971
Area Members	
V. Riley (Wales)	1969
D. H. Mellows (E. Midlands, Lancs., Yorks & N. East)	1969
D. C. Nicolson (Scotland)	1970
R. G. Smith (Midlands, Southern & South West)	1970
R. Luke (N. Ireland)	1971
K. C. Magee (London & East Anglia) ...	1971

Present Members of Council will be eligible for re-election upon retirement (Article 83).

JOINT SCOTTISH BRANCHES

Sixth Scottish Week-End Conference to be held at Gartloch Hospital, Gartloch, Glasgow, by kind permission of the Board of Management for Glasgow North-Eastern Mental Hospitals.

The programme will be as follows:—

Thursday, 3rd October: Assemble and Coffee ... 9.30 a.m.

The Official Opening of the Conference and welcome by the Chairman of the Board of Management for Glasgow North-Eastern Mental Hospitals, Duncan B. Colquhoun, Esq. ... ... 10.00 a.m.

Session 1. Chairman: K. W. Wilson, C.Eng., M.I.Mech.E., M.I.H.V.E., Regional Engineer, Western Regional Hospital Board.

"Modern Trends in Hospital Sterilisers" by Cameron Weymes, T.D., M.D., M.R.C.P.(G.), D.P.H., Medical Superintendent, Victoria Infirmary, Glasgow. ... ... 10.15 a.m.

Session 2. Chairman: P. B. Finnie, F.I.P.C., Director of Cleansing, Corporation of Glasgow.

"Disposal Chutes" by G. Baird, M.Sc., A.M.I.H.V.E., A.M.A.S.H.R.A.E., M.R.S.H., Building Services Research Unit. ... ... 2.00 p.m.

Friday, 4th October: Assemble and Coffee ... 9.30 a.m.

Session 3. Chairman: A. Wotherspoon, C.Eng., A.M.I.C.E., M.I.Mech.E., M.I.E.E., Scottish Development Department.

"Reduction of Electricity Costs" by James D. Thomson, B.Sc., Building Services Research Unit. ... ... 10.00 a.m.

Session 4. Chairman: W. Russel, A.M.I.H.V.E., Regional Engineer, South Eastern Regional Hospital Board.

"Gas goes to Hospital" by P. W. King, Commercial Sales Officer, Scottish Gas Board. ... 2.00 p.m.

Saturday, 5th October: Assemble and Coffee ... 9.30 a.m.

Session 5. Chairman: C. N. Anderson, M.I.E.E., A.M.I.Mech.E., A.M.I.H.V.E., Deputy Regional Hospital Board.

"Open Forum". A selected panel representing Regional Board, Board of Management and Hospital level will endeavour to answer questions on Administration Problems. ... ... 10.00 a.m.

Members of the Panel:

J. Ferguson, A.C.I.S., D.P.P., Group Secretary & Treasurer, Central Lanarkshire Hospitals. W. A. Brown, B.Sc., Principal Assistant Secretary, Western Regional Hospital Board. D. Edgar, A.H.A., Hospital Secretary, Western Infirmary.

Further details can be obtained from: J. Cadenhead, 5 Glen Lee, St. Leonards, East Kilbride. Tel. East Kilbride 29394.

LONDON BRANCH

The sixteenth Annual Ladies Festival of the London Branch will be held at the Hotel Rembrandt on Friday, 11th October, 1968. The Social Committee responsible for its organisation hope that it will, as usual, be well supported.

Applications for tickets should be made on the appropriate Application Form by 21st September next to W. P. Lawrence, the Hon. Festival Secretary. His address is 86, Highdown, Worcester Park, Surrey, and he can be contacted by telephone at TERminus 3611 (Office) and DERwent 2738 (Home).

FIRE PREVENTION CONFERENCE

The British Fire Services Association have arranged a Fire Prevention Conference on Saturday, 26th October, at Leavesden Group Hospital Ballroom, Abbots Langley, Watford, Herts. The conference is open to non-members of the Association and Local Authority, industrial and Hospital Management representatives are invited to attend.

Any inquiries should be addressed to the convenor of the conference: c/o J. F. Leatherbarrow, F.I.C.D., Fire Prevention Department, Leavesden Group Hospital, Abbots Langley, Watford, Herts. Telephone: Garston 722222.

The programme will be as follows:

9.20 a.m.: Opening of the Conference by the Chairman of The Hospital Management Committee, H. B. Eyles, Esq., O.B.E., M.A.

9.30 a.m.: "Application and extinguishment properties of Bromochlorodifluoromethane" (B.C.F.), G. H. J. Elkins, Lc.I.FIRE.E. of Graviner (Colnbrook Ltd.), Slough, Bucks (to be followed by a demonstation).

10.40 a.m.: "Smoke Detectors", V. G. Forsyth, M.A., Minerva Detectors Company Ltd. (followed by a demonstration).

11.30 a.m.: "Chemical Hazards", Divisional Officer J. Taylor, A.M.I.FIRE.E. (Cheshire County Fire Brigade).

Lunch Break: Delegates are invited to use the Social Clubhouse.

1.45 p.m.: Demonstration of First Aid Fire Appliances by The Pyrene Co. Ltd.

2.30 p.m.: "Some Basic Problems in Fire Protection", R. A. Haley, M.I.FIRE.E., Deputy Chief Fire Officer (Staffordshire County Fire Brigade).

4.00 p.m. approximately: "Fire Films". (1) "Pyrene Protects" (Loaned by the Pyrene Co. Ltd). (2) "They call it Fireproof" (Hospital Film) (Loaned by Hertfordshire County Fire Brigade).

PERSONAL

Mr. R. J. Evans, previously Group Engineer to the Stoke Park Group H.M.C., has been appointed Group Engineer to the Springfield H.M.C. at Upper Tooting, London.

Mr. L. F. Gatzias has been appointed Group Engineer and Building Supervisor to Plymouth H.M.C. He moves from the post of Group Engineer to the Royal Buckinghamshire H.M.C.

Mr. G. L. Greenwood has been appoined Group Engineer to the Mid-Herts Group H.M.C. He moves from the Ministry of Public Building and Works.

Mr. D. W. Joyce has been appointed Group Engineer to the Stoke Park Group H.M.C. He is promoted from the post of Hospital Engineer at St. John's Hospital, Stone, Aylesbury, a hospital in the Group.

CHANGE OF ADDRESS

The Vauxhall Boiler Co. Ltd. announce that, in order to rationalise the manufacture of the Company's products within the Babcock & Wilcox Group, the Company's Offices and Works transferred as from 1st June, 1968, to the premises of Penman & Co. Ltd., 64, Strathclyde Street, Glasgow, S.E.

£140,000 HOSPITAL BEAM AND COLUMN ORDER

Anglian Building Products Ltd., of Lenwade, Norfolk have won an order for approximately £140,000 worth of concrete beams and columns for a new general hospital at Crewe.

A GUIDE TO CEILING PANELS

A new publication—"A Quick Guide to Bowater Ceiling Panels" includes the full range of Bowater Ceilings Mineral Board and Insulation Board—together with their respective fixing systems and is available from Bowaters Sales Co. Ltd., Building Products Division, Ceilings Department, 87, King's Avenue, London, S.W.4.

Index to Advertisers

Akroyd, P.R., Ltd.	A.4
Alkaline Batteries Ltd.	—
Allied Ironfounders Ltd.	—
Aluminium Wire & Cable Co. Ltd.	—
Anglo-Swedish Electric Welding Co. Ltd.	A.12
A. P. Green Refractories Ltd.	—
Associated Metal Works Ltd.	—
Auto Diesels Ltd.	—
Babcock & Wilcox Ltd.	Cover ii
Beaumont, F. E., Ltd.	—
Blackstone & Co. Ltd.	215
Bownes & Co.	—
British Castors Ltd.	—
British Oxygen Co., Ltd.	A.5
British Paints, Ltd.	—
British Rototherm Co., Ltd.	—
Brown, Donald (Brownall), Ltd.	A.2
Calomax (Engineers) Ltd.	—
Capecraft Ltd.	—
Cass Electronics Ltd.	—
Cementation Co. Ltd.	—
Cohen, George, Ltd.	—
Davidson & Co., Ltd.	—
Designplan Lighting Ltd.	—
E.D.L. Industries	—
Electro-Hydraulics Ltd.	—
French, Thomas, & Sons, Ltd.	—
G.E.C. (Electronics) Ltd.	—
G & M Power Plant Co. Ltd.	—
Gas Council, The	—
Hampson Industries Ltd.	—
Hobart Manufacturing Co. Ltd., The	—
Hodgkinson Bennis Ltd.	A.3
Homa Engineering Ltd.	—
Honeywell Controls Ltd	A.10
Hume Atkins & Co., Ltd.	—
Jackson Boilers Ltd.	A.2
Jackson Engineering (Beckenham) Ltd.	—
John Thompson (Shell Boilers) Ltd.	—
Kenyon, James, & Son, Ltd	—
Kew Copper & Sheet Metal Co.	Class. Ads.
Lime-Free Water and General Services Ltd.	—
Lister, R. A., & Co., Ltd.	—
Loughborough Oven Works Ltd.	—
Manders Paints Ltd.	A.11
Manlove, Alliott & Co., Ltd.	Back Cover
Marconi International Marine Co. Ltd., The	—
Matthew Hall Ltd.	—
Mellor Bromley (Air Conditioning) Ltd.	—
National Chemsearch (U.K.) Ltd.	—
National Coal Board	—
Newalls Insulation & Chemical Co. Ltd.	A.9
Nife Batteries	—
Norman Engineering Co.	A.12
Permutit Co. Ltd.	—
Power Utilities Ltd.	—
Radiation Catering Equipment Ltd.	A.8
Riley (IC) Products Ltd.	—
Rolls Royce Ltd.	A.4
Ruston & Hornsby Ltd.	—
Sierex, Ltd.	A.1
SK Instruments Ltd.	—
Spirax-Sarco Ltd.	A.6
Steelway Ltd.	—
Sulzer Bros. Ltd.	—
Tett, G. S., & Co. Ltd.	Cover iii
Thackray, Chas. F., Ltd.	Front Cover
Tile Floors Ltd.	A.4
Transcall Ltd.	—
Tullis, D. & J., Ltd.	—
Universal Machinery and Services Ltd.	—
Venesta Manufacturing Ltd.	—
Wandsworth Electrical Mfg. Co., Ltd.	—
York Shipley Ltd.	—

Classified Advertisements

SITUATIONS VACANT

WESSEX REGIONAL HOSPITAL BOARD

DO YOU WANT TO TRAIN AS A HOSPITAL ENGINEER IN THE NATIONAL HEALTH SERVICE?

Applications are invited from young men who have successfully completed the H.N.C. A.1 course in Mechanical or Electrical Engineering.

Trainees will be appointed as Assistant Engineers (Salary scale £975 rising by eight annual increments to £1,270 per annum).

Day release granted to study for professional qualifications.

Training programmes over a two-year period are designed to suit individuals; affording excellent experience in maintenance and some design over a wide range of hospital engineering services, e.g. boiler and water treatment plant, heating and ventilation, major operating theatre equipment, laundry machinery, etc.

Applications giving age, full details of education and experience, and names of two referees to the Secretary, Highcroft, Romsey Road, Winchester, by 30th September, 1968.

THE UNITED SHEFFIELD HOSPITALS
GROUP ENGINEER

required for this group of teaching hospitals with 1,448 beds. Salary £2,050 to £2,430 plus £200 allowance special responsibilities.

Qualifications required:-

H.N.C. or H.N.D. in Mechanical Engineering with endorsements in Industrial Organisation and Management and Principles of Electricity or Electro-Technology, if this was not taken as a subject of the course; or equivalent.

Applicants must have a sound knowledge of the principles and practice of the efficient operation of steam boiler plant and have had a wide experience in a supervisory capacity of mechanical and electrical engineering services found in hospitals.

Further details from the Chief Administrative Officer, United Sheffield Hospitals, 10 Beech Hill Road, Sheffield, S10 2RZ, to whom applications should be made by 7th October, 1968.

DONCASTER HOSPITAL MANAGEMENT COMMITTEE

DEPUTY GROUP ENGINEER

Applications are invited for the post of DEPUTY GROUP ENGINEER, salary scale £1,370 x 5 inc. to £1,605 p.a. plus £100 p.a. special responsibility allowance.

The person appointed will be required to act for the Group Engineer over the whole range of his duties.

Applicants must have completed apprenticeship in electrical engineering and have acquired thorough practical training as appropriate to duties and responsibilities of post. Must have wide experience in the management of mechanical and electrical plant, particularly on a planned basis. Experience must include control of maintenance staff, also preparation of maintenance estimates, specifications and drawings.

Applicants must hold following qualifications or approved equivalent:—

H.N.C. or H.N.D. in Electrical Engineering with endorsements in Industrial Organisation and Management and including (at S3 or O2 level, or with endorsement in) Applied Heat and Applied Mechanics, provided he has the necessary practical experience in Mechanical Engineering.

Temporary rented accommodation will be available to successful applicant.

Applications stating qualifications, age and experience, with names and addresses of 2 referees (1 technical) to Group Secretary Doncaster Royal Infirmary, Doncaster, within 7 days of publication of this advertisement.

DONCASTER HOSPITAL MANAGEMENT COMMITTEE

HOSPITAL ENGINEER

Applications are invited for the above post in No. 3 Engineering Sub-Group, comprising Western, Conisbrough and Fullerton Hospitals.

Applicants must have a thorough knowledge of steam boilers, their operation and maintenance, steam distribution, a wide experience of mechanical and electrical plant, also knowledge of its maintenance on a planned basis, and should possess one of the following qualifications or its approved equivalent:-

(i) City and Guilds Mechanical Engineering Technicians Certificate (Part II) which must include Plant Maintenance and Works Service; or

(ii) City and Guilds Certificate in Plant Engineering; or

(iii) Ministry of Transport First Class Certificate of Competency if it includes an O.N.C. or O.N.D.

Salary £1270 x 5 inc. to £1500 p.a. plus unit allowance of £25 p.a.

Temporary rented accommodation to successful applicant if required.

Applications stating age, full details of experience qualifications and names of two referees to Group Engineer, St. Catherine's Hospital, Tickhill Road, Doncaster, Yorks, within 7 days of publication of this advertisement.

LEICESTER NO. 3 HOSPITAL MANAGEMENT COMMITTEE

GROUP ENGINEER

required for this Group of eight hospitals for the mentally ill and mentally subnormal totalling 1,742 beds.

The post, which becomes vacant from 1st September, 1968, carries responsibility for the operation and co-ordination of the full range of mechanical and electrical services, including a Group Laundry.

Applicants must have had wide practical experience in the management of mechanical and electrical engineering plant and hold at least one of the following qualifications:—

(i) H.N.C. or H.N.D. in Mechanical Engineering with endorsements in Industrial Organisation and Management and Principles of Electricity or Electro-Technology, if this was not taken as a subject of the course.

(ii) H.N.C. or H.N.D. in Electrical Engineering with endorsements in Industrial Organisation and Management and including (at S.III or O2 level, or with endorsements in) Applied Heat and Applied Mechanics, provided there has been suitable practical experience in mechanical engineering.

Conditions of service in accordance with the Whitley Councils for the Health Service. Salary: £1,650 x 55 (4) x 60 (1)-£1,930, plus responsibility allowance of £50 per annum.

The officer appointed will be required to reside within easy reach of the Towers Hospital and a detached house is available if required on the hospital estate.

Applications, stating full details of posts held and qualifications, together with the names of three referees, to be sent to the Group Secretary, Leicester No. 3 Hospital Management Committee (from whom further particulars can be obtained on application), Towers Hospital, Humberstone, Leicester, LE5 OTD.

SOUTH WEST MIDDLESEX HOSPITAL MANAGEMENT COMMITTEE

Applications are invited for the following posts at WEST MIDDLESEX HOSPITAL, ISLEWORTH

1. HOSPITAL ENGINEER—Salary scale for points range "24½ and over"—£1,370-£1,605 p.a. plus £100 p.a. special responsibility allowance, plus £90 p.a. London Weighting.

2. ASSISTANT ENGINEER—Salary scale £975 to £1,270 p.a. plus £90 p.a. London Weighting.

West Middlesex Hospital (946 bedded general hospital) has a modern boiler house with fully automatic oil-fired boilers and a new 236 bedded Medical Department ('race-track' design with full air-conditioning). These posts offer exceptional variety of experience to Engineers who are keen to progress to the higher posts in the Health Service.

Application forms, together with further particulars, obtainable from and returnable to the Group Secretary, South West Middlesex Hospital Management Committee, West Middlesex Hospital, Isleworth, Middlesex, by 1st October, 1968.

QUEEN CHARLOTTE'S AND CHELSEA HOSPITALS

HOSPITAL ENGINEER required. Major building project due to begin shortly. The successful candidate will have the O.N.C. or equivalent and be accustomed to interpret drawings and specifications and to set out jobs for tradesmen. Salary £1,345 rising to £1,575 per annum plus London Weighting. Accommodation adjacent to Queen Charlotte's Maternity Hospital will be available within some months.

Applications to be sent to the House Governor, 339 Goldhawk Road, London, W.6, within three weeks of the appearance of this advertisement.

ABERDEEN GENERAL HOSPITALS

ASSISTANT ENGINEER

Applications are invited for the appointment of an Assistant Engineer to undertake duties in this Group of Hospitals.

The salary scale for the post is £975 per annum rising to a maximum of £1,270 per annum and increments of up to £70 may be awarded in respect of relevant experience since the completion of practical training. The post is superannuated and is in accordance with Whitley Council Agreements.

Applicants must have had a practical training in Mechanical or electrical engineering and qualified to at least O.N.C. level or equivalent.

Applications stating age, qualifications and experience together with the names of two referees should be lodged with the Group Secretary, Aberdeen General Hospitals, Foresterhill House, Ashgrove Road West, Aberdeen, AB9 8AQ, immediately.

ELECTRICAL ENGINEER

MINISTRY OF WORKS

KENYA

DUTIES: To be responsible for entire hospital maintenance including buildings, building services and equipment; liaising with Ministry of Health on hospital design; the training of local staff.

QUALIFICATIONS: Applicants, aged up to 50 years, must be M.I.E.E. or possess a qualification accepted by the Institution as equivalent and have considerable relevant experience.

TERMS: Basic salary, according to experience in scale £Kenyan 975 p.a. rising to £Kenyan 1,791 p.a. (£Sterling 1,138-2,090 p.a.) liable to Kenya income tax. In addition, an allowance, normally tax-free, ranging from £Sterling 752 to £Sterling 958 p.a. will be paid by the British Government direct to the officer's bank account outside East Africa; 25 per cent terminal gratuity; initial contract for two years.

Free family passages and medical attention; children's education allowances; accommodation at moderate rental.

Applicants, who should normally be nationals and permanent residents of the United Kingdom or the Republic of Ireland, should write, giving full name, age, brief details of qualifications and experience to:

Appointments Officer, Room 301,
MINISTRY OF OVERSEAS DEVELOPMENT,
Eland House, Stag Place,
London, S.W.1.

quoting Ref. No. RC 210/95/03.

ASSISTANT HOSPITAL ENGINEER required at the Lawn Road Branch of the Royal Free Hospital to assist with all aspects of mechanical and electrical services in two hospitals in Hampstead where large capital projects are in progress. The post offers valuable experience for engineers wishing to take up hospital engineering as a career. Alternatively an older man would be considered.

Applicants must have completed an apprenticeship and preferably hold an Ordinary National Certificate in Engineering.

Salary scale will be £998 per annum rising to £1,198 for a 38-hour week.

Applications to Chief Engineer, Royal Free Hospital, Gray's Inn Road, London, W.C.1.

HOSPITAL ENGINEER

Vacancy due to retirement.

Successful applicant to be responsible to the Group Engineer for the engineering and building staff at Normansfield Hospital (mental subnormality, 298 beds), Kingston Road, Teddington, and to have completed training by apprenticeship or otherwise to hold appropriate qualifications and to be widely experienced in hospital or similar work.

Salary Scale £1,270 to £1,500 per annum plus £25 p.a. special responsibility, plus London Weighting Allowance.

Accommodation available. Detailed applications giving three employment referees to Group Secretary, Ashford Hospital, London Road, Ashford, Middlesex, not later than 30th September, 1968.

THE HOSPITAL, GRASSINGTON, NEAR SKIPTON, YORKSHIRE

HOSPITAL ENGINEER

The above appointment will become vacant due to the retirement of the present holder early in 1969. His successor will be responsible directly to Group Engineer for the maintenance of engineering services, for day-to-day supervision of building maintenance, and for fire-protection, at this psycho-geriatric hospital of approx. 280 beds.

Applicants must have acquired a thorough practical training as appropriate to the duties and responsibilities of the post and must hold one of the following qualifications or an approved equivalent:-

(i) City and Guilds Mechanical Engineering Technicians Certificate (Part II) which must include Plant Maintenance and Works Service; or

(ii) City and Guilds Certificate in Plant Engineering; or

(iii) Ministry of Transport First Class Certificate of Competency which includes an Ordinary National Diploma or Ordinary National Certificate.

Salary scale £1,270 to £1,500 per annum, plus special responsibility allowance of £25.

The Officer appointed will be required to reside on the hospital estate and a house is available at moderate rental.

Applications stating age, training, qualification and experience, naming three referees, to Group Secretary, High Royds Hospital Management Committee, High Royds Hospital, Manston, Ilkley, Yorkshire, by 25th October, 1968.

ST. MARY'S HOSPITAL, LONDON, W.2

HOSPITAL ENGINEER

HOSPITAL ENGINEER required to be responsible for engineering and building maintenance and to assist with preparation of minor capital work projects with the St. Mary's Group of Hospitals. Salary scale £1,270-£1,500 per annum, plus £90 London Weighting Allowance.

Candidates must hold one of the following qualifications or approved equivalent:—

1. Higher National Certificate or Higher National Diploma in Mechanical Engineering with endorsements in Industrial Organisation and Management and Principles of Electricity or Electro-Technology, if this was not taken as a subject of the course; OR

2. Higher National Certificate or Higher National Diploma in Electrical Engineering with endorsement in Industrial Organisation and Management and including (at S.III or O2 level, or with endorsement in) Applied Heat and Applied Mechanics, provided he has suitable practical experience in mechanical engineering.

Applications giving full details of age, qualifications and experience, together with the names of two referees, should be sent to the Establishment Officer.

CARDIFF HOSPITAL MANAGEMENT COMMITTEE

Applications are invited for the appointment of HOSPITAL ENGINEER to be responsible to the Group Engineer for the Engineering Services at Sully Hospital, Sully, Nr. Penarth, Glamorgan. Salary scale £1,270-£1,500 plus £25 for special responsibility. Applicants must have completed an apprenticeship in Mechanical or Electrical Engineering, or have otherwise acquired a thorough practical training as appropriate to the duties and responsibility of the post. Applicants must be in possession of H.N.C. or H.N.D. or equivalent qualification approved by the Minister of Health. They should also have a sound knowledge of the efficient operation of mechanical fired steam boiler plants, and a wide experience of mechanical or electrical services in Hospitals. Application forms from the Group Secretary, Cardiff H.M.C., 44 Cathedral Road, Cardiff. CF1 9XP.

BROOKWOOD HOSPITAL MANAGEMENT COMMITTEE
BROOKWOOD HOSPITAL, KNAPHILL,
WOKING, SURREY

HOSPITAL ENGINEER

in this single Hospital Group (1,652 Beds).

The successful candidate will be directly responsible to the Group Engineer and will be required to act for him over the whole range of his duties during his absence.

Applicants must have acquired a thorough practical training appropriate to the responsibilities and duties of the post, and should hold one of the qualifications listed in the Whitley Council Conditions or an approved equivalent.

Applications will also be considered from suitably experienced Engineers not holding these qualifications.

Salary Scale: £1,370 x £40 (1) x £45 (2) x £50 (1) x £55 (1)—£1,605 (from 1.9.68) per annum plus £50 per annum for special responsibility units. Salary to be abated by £200 p.a. if not in possession of approved qualifications.

Applications, giving details of age, training and qualifications, with names and addresses of three referees (one technical) to the Group Secretary at the above address not later than 30th September, 1968.

A house is available on the Hospital estate at moderate rental.

LEICESTER NO. 3 HOSPITAL MANAGEMENT COMMITTEE

Applications are invited for the post of HOSPITAL ENGINEER to be responsible to the Group Engineer for the engineering services at Glenfrith Hospital, Leicester, and associated Hospitals, at a salary scale of £1,370—£1,605 per annum, plus an allowance of £25 p.a.

Applicants must have completed an apprenticeship in mechanical or electrical engineering or have otherwise acquired a thorough practical training, and should hold an Ordinary National Certificate, City and Guilds Certificate or equivalent qualifications. The salary of applicants not qualified in accordance with Ministry of Health regulations would be abated by £200.

The post includes some Planned Preventive Maintenance and responsibility for any supervision of engineering and maintenance staff at these hospitals.

A house at low rental is available.

Applications, stating age, experience, and the names and addresses of three referees, should be sent to the Group Secretary, Leicester No. 3 Hospital Management Committee, The Towers Hospital, Humberstone, Leicester, LE5 OTD.

MISCELLANEOUS

ENGRAVED PLASTIC NAME PLATES AND STAFF IDENTITY BADGES manufactured. Single or quantities. Workshops for the Disabled, Northern Road, Cosham, Portsmouth. Tel.: Cosham 76533.

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

GUILLOTINES. Revolutionary "GABRO" machines provide 0 to 10G (12G Stainless) Capacity, straight and notching, to UNLIMITED, UNDISTORTED length for £60. Full details, GALE BROS. (ENGINEERS) LTD., Smallfield, Horley, Surrey. Tel.: Smallfield 2157.