Hospital Engineering

The Journal of the Institute of Hospital Engineering

1945–1970 25th anniversary

Vol. 24 September 1970

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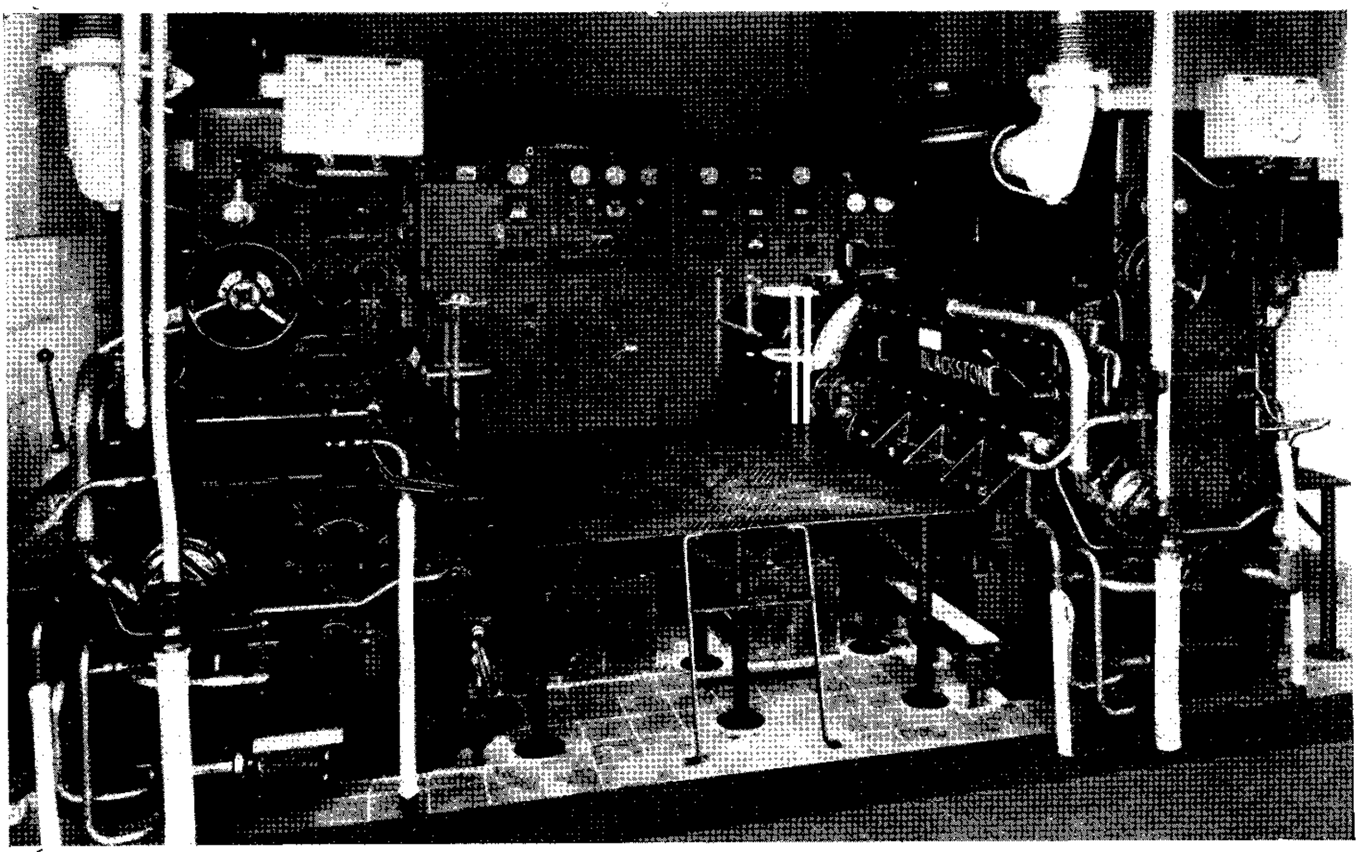

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A Register for all

For the benefit of Members, present and future, it is felt that this Institute should indicate its position with regard to the proposed composite register for engineers.

Members may have read that a company called SCTET (Standing Conference for Technician Engineers and Technicians) proposed to begin operating a Register as from the 1st July 1970. SCTET is a Company, Limited by Guarantee, formed by a number of the constituent members of SCNQT (Standing Conference for National Qualification and Title).

In a press release issued on the 1st July 1970 by SCTET, it was stated:

> As it has always made clear, SCTET intends that these new registrants shall form part of a single composite National Register, together with the Chartered Engineers and, eventually, with the Registered Technicians. To this end SCTET is urgently pressing for constructive discussions with the Council of Engineering Institutions (CEI) and other interested bodies.

On the 7th July 1970, CEI issued a Memorandum to interested parties which read:

> **CEI register for the engineering community**
>
> On July 3rd the CEI Board unanimously passed Special Resolutions proposing changes in its Charter and Byelaws to be forwarded to the Privy Council for approval to establish and maintain a composite register for the three sections of the engineering community.
>
> The three sections of the Register would deal, respectively, with the chartered engineer, the nonchartered engineer and the technician. The designatory letters for those individuals nominated by their Institutions or Societies to the new sections of the CEI Register would be:
>
> | | |
> |---|---|
> | nonchartered-engineer section | CEI.T.Eng. |
> | technician section | Tech.CEI |
>
> As already announced on the 17th June 1970, CEI is setting up the nonchartered-engineer section forthwith, and also announces its intention to introduce the technician section as soon as practicable thereafter.
>
> While the Privy Council have already intimated their agreement in principle to the establishment by CEI of such a register, and to the granting of titles and designatory letters, it will take time for the formal submissions to be approved and for consultations in detail to take place between CEI and those Institutions and Societies that will be involved.

The Institute of Hospital Engineering, in company with a number of senior Institutes and Institutions outside CEI, witheld from a commitment of support for SCTET on the one hand because of the proposed method of operation, and on the other hand, and primarily, because it was felt that fragmentation was not in the best interests of Engineering generally. The profession could best be served by the operation of a national register for all engineers operated under the 'umbrella' of the CEI.

Accordingly, this Institute and others have indicated to CEI that they would wish to co-operate in a Register established under the auspices of the CEI Charter, provided that the method of operation is considered acceptable.

It is emphasised that no engineer can, or will be able to, register directly with the registration authority (CEI or SCTET), but will be obliged to register through the Institute of which he is a member.

Further information will be published as soon as possible.

This paper has been presented to the Midlands Branch of the Institute

DISCOVERY AND DEVELOPMENT OF NATURAL GAS FROM THE NORTH SEA

BY
D. SCOTT WILSON,
M.B.E., A.R.I.C.,
C.Eng., M.I.Gas E.

1 Introduction

The last six or seven years have witnessed the bringing about of a major technological revolution in the gas industry—in the field of gas production. Traditionally, town gas was made from coal by the carbonisation process; a process that had remained virtually unchanged for nearly 150 years. For many reasons, technical and economic, the industry instituted an ambitious research programme in its own research stations in the middle 1950s, with the object of designing processes for the production of gas from alternative feedstocks. The obvious feedstock to turn to was oil. These researches have been completely successful, and three completely novel processes have been brought to full scale in the industry's own works for the production of town gas from oil, and these are now being widely operated. The speed at which this change from coal to oil as the major feedstock has been achieved can be judged from the fact that in 1960 the industry still made over 90% of all its gas from coal. In 1967–68 under 35% was made from coal.

Now very large reserves of natural gas have been discovered under the North Sea, and the gas industry finds itself faced with a second, much greater, revolution.

2 Formation and nature of natural gas

Throughout the world there occur in certain rock formations accumulations of a complex mixture of hydrocarbons to which the name 'petroleum' has been given. In its natural state this petroleum can exist in liquid or gaseous form.

Natural liquid petroleum is known as 'crude oil'. It consists of liquid hydrocarbons and occurs below the surface of the Earth, although it sometimes escapes through vertical fissures to form natural seepages. Crude oil is the feedstock for oil refineries, where fractional distillation separates off motor fuel (petrol), kerosene, paraffin, gas oil, diesel oil and fuel oil.

Gaseous petroleum is called 'natural gas' and consists of lighter hydrocarbons which may be gaseous underground, but anyway become gaseous when they reach the surface. These are mainly methane, ethane, propane and butane; usually 90% or more methane. Natural gas occurs below the surface of the Earth, although like crude oil it sometimes escapes to the surface. References throughout history to pillars of fire and the like could have been due to natural-gas seepages which had been ignited, perhaps by lightning.

Commercial deposits of petroleum can exist only if the geological conditions were favourable for their formation

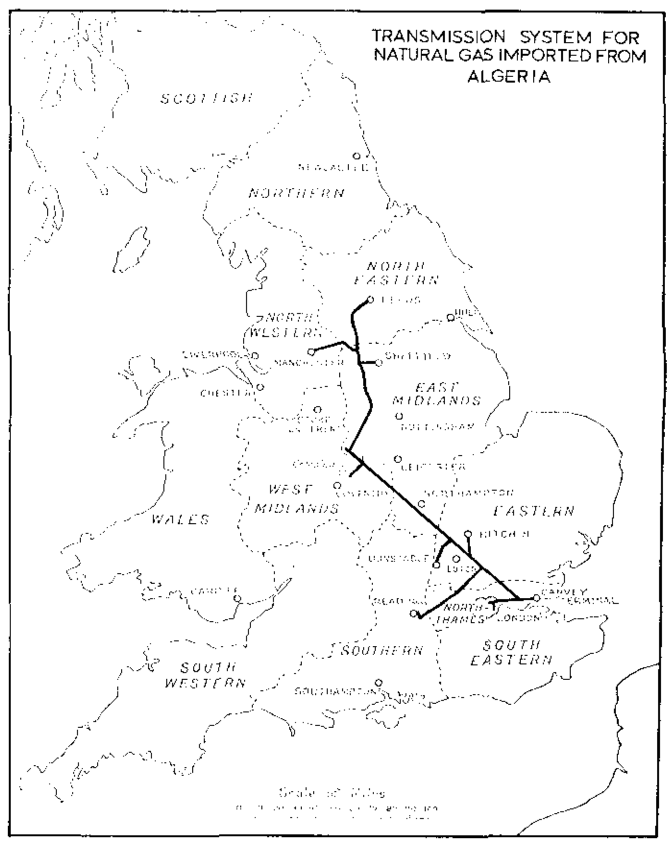


Fig. 1. Original natural-gas transmission system

Mr. Scott Wilson is Scientific Information Officer, the Gas Council in the first place. It is generally accepted that the origin of the bulk of the world's present accumulations lies in the deposition of marine organisms after death on the sea floor. These organisms, which include plankton, bacteria and simple plants, accumulate with large quantities of inorganic particles deposited by rivers or through chemical precipitation. Subsequent deposition causes the earlier sediments to become buried and to start to compact. Bacterial action and the catalytic action of minerals in the deposits can form hydrocarbons under the high pressure and temperature conditions prevailing in these strata. A second possible source of natural gas is from very deep coal measures, where petroleum can be formed under the action of extremes of heat and pressure. The gas so far discovered under the North Sea was almost certainly formed by this route.

Oil or gas is rarely found in the rock layer in which it was actually formed. Above the oil-bearing rocks there are usually layers of porous rock—solid-looking, but permeated with minute pores. The total pore volume may perhaps amount to as much as a quarter of the total volume of the rock. The pores are originally filled with sea water, but if oil or gas is formed below, these, being lighter than water, will float upwards through the water in the pores, ultimately completely displacing the water. Further upward migration of the petroleum will be prevented if above the layer of porous rock there is a layer of impermeable rock, such as rock salt. Such a layer is known as a 'cap rock'. If a large reservoir of oil or gas has formed, migration of the petroleum laterally under the cap rock must have been prevented; otherwise, at some stage in geological history, the petroleum would have migrated beyond the confines of the cap rock, so escaping upwards.

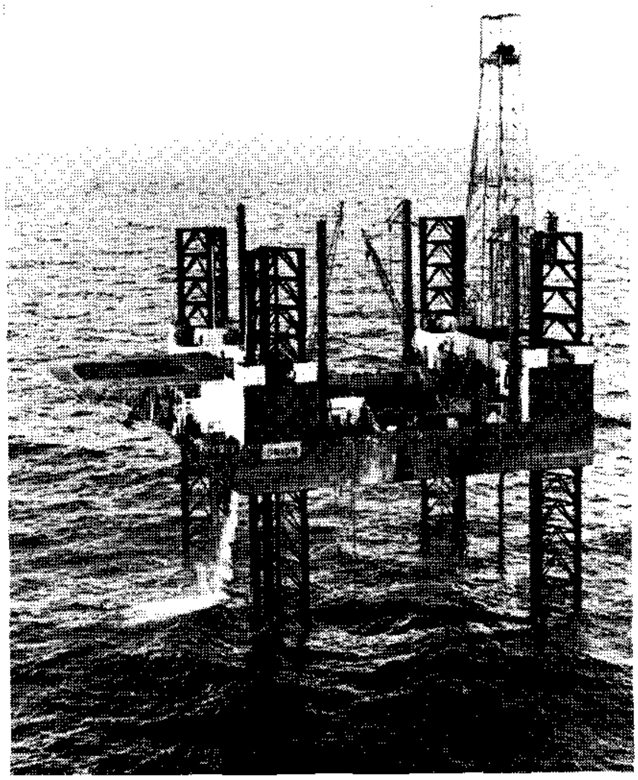


Fig. 2. 'Orion', the jack-up rig designed specifically for drilling in the North Sea

Lateral migration under the cap rock is prevented if the rock structure has the right shape to form a trap. The most common form of trap is a fold in the underground sedimentary layers, known as an anticline. An anticline can be looked upon as a basin inverted to stand on its rim. The basin itself is made of the cap rock, while inside it is porous rock. If petroleum is formed below the inverted basin, it will move upwards through the water in the pores of the porous rock to the top of the basin, pushing the water out of the pores outwards and downwards towards the rim, so forming a reservoir of oil or gas in the pores of the rock at the crest of the anticlinal structure.

3 The search for gas under the North Sea

The presence of gas or oil under the North Sea had been a subject of speculation among geologists long before the present intensive search was started. The geologist looking for gas or oil must first determine the marine areas of the past that could have been favourable to the formation of petroleum, and then search within those areas for suitable structures, such as anticlines, where petroleum could have accumulated. The area of the North Sea has both of these qualifications.

It has been known for a long time that coal-bearing rocks existed under the North Sea area at average depths of 10 000 to 20 000 ft, extending under Holland and Belgium, the North Sea and much of the UK. Above this, covering much the same area, was a layer of porous sandstone, the Rotliegendes sandstone, some 500 ft thick, and above this a very thick layer of rock salt, in places up to a mile thick. This rock-salt layer is not coterminous with the two layers beneath it, stopping short under a narrow coastal strip of the UK in the Yorkshire/Lincolnshire area. Elsewhere, it extends under much of the North Sea and Holland. Geologically, therefore, the favourable area to find oil or gas would be under Holland, the North Sea and the narrow coastal strip of England. It is reasonable to ask why it is only now that a search has been made in the major part of this formation, the North Sea itself. Firstly, exploration had to await the development of equipment and techniques to drill down some two miles or more, starting from the surface of the sea, and then there had to be a strong probability of the presence of really large reservoirs to justify the enormous expense of this exploratory drilling.

Exploration on the continent of Europe and in the UK from the 1930s onwards had provided evidence of small oil and gas fields, but there was little encouragement to undertake the expense of searching for and developing a possible field under the North Sea on this evidence alone. The picture was dramatically changed on the 14th August 1959.

Traces of oil and gas had been found in Holland before the last war, and by 1959 over 800 wells had been drilled. Of these, some 200 were exploratory, or 'wildcat', wells, and only small amounts of gas had been found. At Slochteren, a village in the Groningen province of northern Holland, a well was being drilled in 1959 as part of a joint enterprise by Shell and Esso. It was just another exploratory well—until it struck gas on the 14th August. It was gas in enormous quantities. Further drillings confirmed the vast size of the find; the latest figure for the probable volume of the reserves of gas in this field is 60×10^{12} ft^3—enough gas to supply the present level of British gas consumption for about 100 years. After this find at Slochteren it was obvious that all previous ideas about exploration needed drastic revision, and the necessary spur was now there to stimulate exploration under the North Sea itself.

By magnetic and seismic methods of exploration the location and size of suitable anticlinal structures can be determined. Such geophysical prospecting cannot locate petroleum itself; so the next step is to drill wells into the structures to see what is actually there. The essentials for this are a platform with machinery to turn a long 'string' of steel pipe, to the lower end of which is fixed the drilling bit. The platform may be a specially designed ship, or a semisubmersible platform carried on buoyancy tanks floating well below the surface of the water, or a self-elevating rig (a 'jack-up' rig) towed out to the site where legs are lowered to touch the sea bed; further jacking raises the platform clear of the water.

Associated with the drilling of wells at sea are many ancillary services. A shore base is required to handle and store materials and to transfer these goods to and from two or more support ships designed to carry pipe, 'mud', cement, stores and a few passengers. Helicopters are used for most passenger services and for special emergency duties. There is spoken voice and telex radiocommunication between rig and shore. The 'mud' (actually a plastic polymer) is pumped down the inside of the drill pipe. Its main functions are to contain the reservoir fluid pressure, to cool the bit, to return the cuttings to the surface by way of the annular space between the pipe and the drilled hole, and to plaster the walls of the hole to prevent caving in.

If gas (or oil) is discovered, further exploratory wells are drilled to determine the size of the reservoir, and if this is commercially viable, the field is made operational by the construction of one or more permanent fixed platforms to bring the gas to the surface. An undersea pipeline has then to be laid to carry the gas to the shore, where a terminal is built to receive it.

This shore station has a number of tasks to perform. Condensate has to be removed from the gas, the gas dried, its pressure regulated and the gas metered. The action of reducing the gas pressure from about 3000 lbf/in^2 in the undersea pipeline to below 1000 lbf/in^2 causes a sharp fall in temperature; so the gas is passed through heaters immediately before the pressure-reduction point. Finally, an odorant is added to the gas to give it the same smell as town gas. A control room, manned round the clock, provides automatic computer control of gas flow and pressure, and also instrumentation for recording important properties of the gas.

4 Existing transmission and distribution system

One very useful outcome of the new processes for making town gas from oil was that one of the new processes could use natural gas in place of oil as the raw material, and manufacture from it an ordinary town gas. Since at this stage, the second half of the 1950s, the UK had no natural gas of its own, the Gas Council began to explore the technical and commercial possibilities of importing gas from overseas fields. This was prior to the Dutch discovery at Slochteren, and the nearest large natural-gas field was in Algeria.

Liquid natural gas, at the very low temperature of $-160°C$, is carried in two special ships, each designed to carry 12 000 tons of the liquid. The natural gas is pumped from the gas field at Hassi R'Mel to the Mediterranean port of Arzew, where it is liquefied in a plant capable of liquefying 200 Mft^3/day of gas. The two ships bring the liquid to Canvey Island, in Essex, where a special terminal was built to store the liquid and regasify it. From Canvey the gas is transmitted through a high-pressure trunk pipeline extending from Canvey to Leeds, which has branches to feed bulk supplies of the gas to eight out of the twelve Area Boards supplying gas to this country (see Fig. 1). This whole project became operational in 1964, so that for almost exactly four years natural gas had been transmitted in bulk up and down the country through the Canvey–Leeds pipeline to the eight Area Boards, which have used it in place of oil to make ordinary town gas. When the scheme went to work, the total quantity of gas so imported amounted to about 10% of the total gas supply of the UK. The Area Boards themselves have been building up grid transmission systems within their own areas, off which come the distribution pipes in the individual towns and streets.

The gas industry was therefore extremely fortunate when the North Sea discoveries were made, since a large high-pressure transmission system already existed, into which the transmission system for the new source of gas could be grafted.

5 The natural gas fields of the North Sea

In July 1964 the Continental Shelf Act, following a Geneva Convention ratified by 22 countries, came into force. The Convention defined the territorial areas of the North Sea for the seven nations bordering it, and made possible an orderly system of licensing and control. Concessions have been granted in the UK area of the North Sea to some 24 groups of companies to drill for gas or oil in specified 'blocks', each some 100 $mile^2$ in extent.

The first major strike of natural gas was made by British Petroleum late in 1965 in the Rotliegendes sandstone some 42 miles off the Humber estuary, and by the end of December 1965 it was clear that gas would be available from this source in quantities which would justify piping it to land. In the two years since then, three further large, distinct natural gas fields have been discovered, and the Gas Council states that these first four fields together contain over $25 \times 10^{12} ft^3$ of gas—enough to provide between three and four times the present average output of the British gas industry for at least 30 years. There are good prospects that further fields will be discovered, and the Gas Council is satisfied that the present known reserves alone justify the creation of a natural-gas industry in Britain, in order, ultimately, to supply the new gas direct to the consumer without any intervening processing.

Fig. 2 shows the names and locations of the four gas fields discovered so far, and the names of the groups concerned in the drilling that resulted in the discoveries. It also shows the proposed pipelines to bring the gas from the fields into the industry's transmission and distribution system.

An undersea pipeline has already been laid from the West Sole field (the first to be discovered) to a shore station at Easington in Yorkshire. From the shore station a 24 in-diameter high-pressure pipeline, the No. 1 Feeder, has been laid under the Humber and across country to tee into the existing Canvey–Leeds pipeline at Totley, near Sheffield. Since the middle of 1967 natural gas from the North Sea has been passing through this pipeline; the contract with British Petroleum providing for an average of 100 Mft^3/day (about the same quantity as is supplied by the Algerian scheme).

The next stage will be to bring the gas ashore from the other three fields at a second, larger, terminal at Bacton on the Norfolk coast. Work is now complete on the fixed platforms on the Leman Bank field, and on the undersea pipeline from this field to Bacton, where the shore station is also complete. It is expected that the first gas from Leman Bank will come ashore in August 1968. As will be seen from the map, four feeder pipelines are proposed to transmit the gas from Bacton to the transmission system. The one shown as a solid line, known as the No. 2 feeder main, is 36 in in diameter, and is now built and ready to take gas. The 125 miles of pipe will carry the gas across country to avoid interference as far as possible with built-up areas, but it does pass close to King's Lynn, Wisbech, Peterborough, Stamford, Corby and Market Harborough, to feed into the Canvey–Leeds main at Churchover, near Rugby. The pipeline will be capable of delivering up to 1000 Mft^3/day, equal to the average demand in the whole of Britain at the present time.

The other three feeder pipelines from Bacton will be completed between now and the end of 1970. Work has also been started on further pipelines to extend the bulk-transmission system, at present feeding only eight Area Boards, to all twelve Boards. These comprise a pipeline from the Canvey–Leeds pipeline near Rugby to feed into the South-Western Board's system and into the southern part of the Wales Board's system. Another branch will feed into the northern part of a Wales Board's system, and will also provide branches for additional supplies to the North-Western and West-Midlands Boards. The original Canvey–Leeds main will be duplicated northwards from Rugby, and extended to Newcastle and Glasgow to provide supplies for the Northern and Scottish Boards. All these pipelines will be completed by the end of 1970, some of them earlier. One further pipeline is already under construction and should be completed this year.

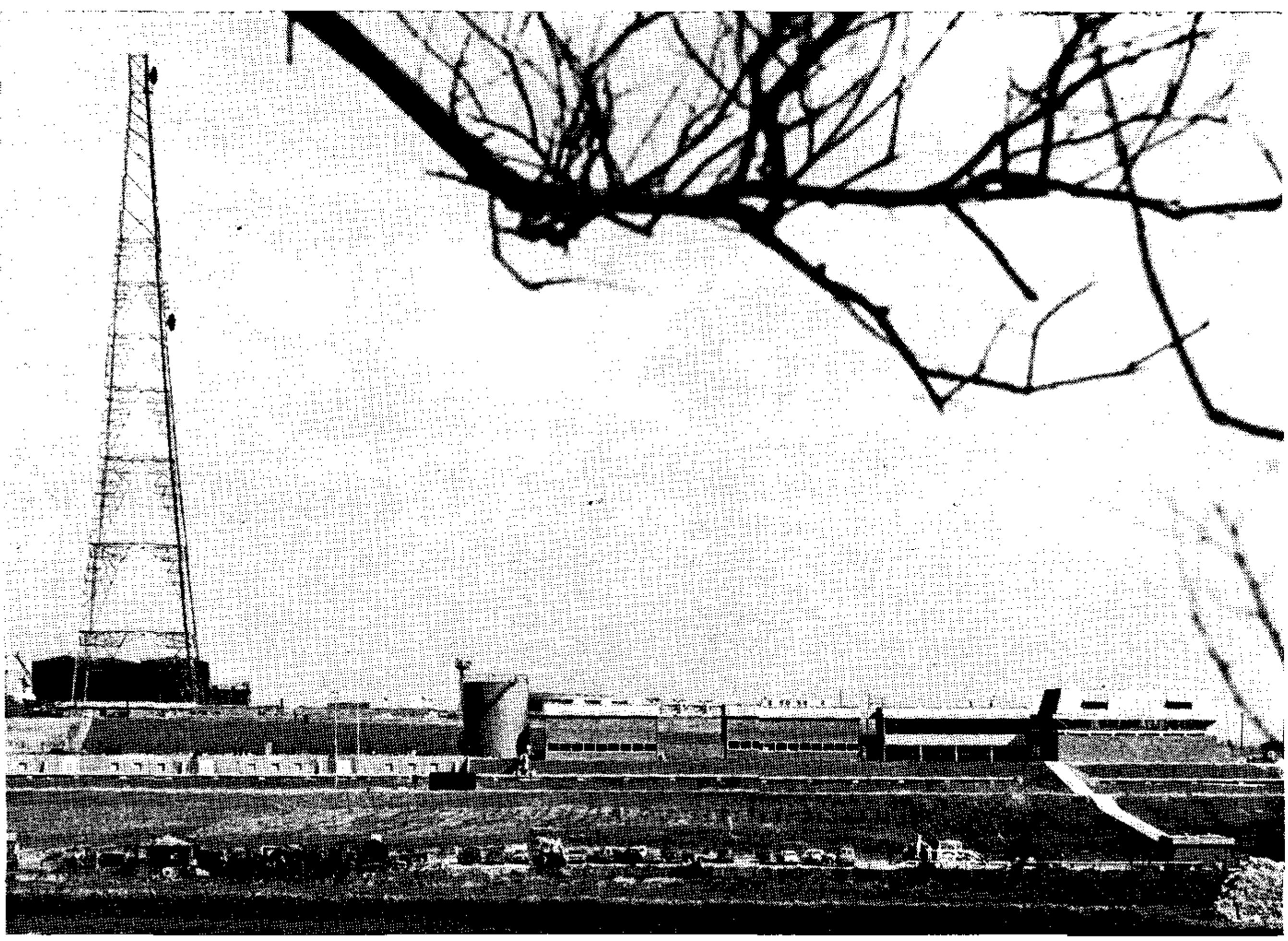


Fig. 3. The Gas Council's North Sea gas terminal at Bacton, Norfolk

This runs from the Canvey–Leeds main near Stevenage, Herts., south-westward and southward to provide additional supplies to the North Thames, South-Eastern and Southern Boards.

By 1970, there will be a bulk-transmission system capable of taking three to four times as much gas as is made in Britain at present and delivering it to all twelve Area Boards. The Boards may then distribute this through their existing distribution grids direct to the consumer, but, unfortunately, this direct transmission from the shore to the consumer cannot be done immediately, since natural gas is not compatible with existing town gas. Until the necessary conversion of appliances has been carried out, the gas will be used in the same way as the imported Algerian gas to make normal town gas.

6 Other features of the North Sea project

Peak-load storage of gas

For seasonal peak-load purposes it is necessary to have strategic storage of large quantities of gas readily available. Because of the high cost of drilling wells in the North Sea, it is not economic to use the natural gas fields themselves to supply large amounts of peak-load gas over and above the normal base load. The Gas Council has therefore decided to store gas in liquid form, either in special above-ground tanks, or in frozen underground storage. The latter is already in use at Canvey to store the imported liquid natural gas. The first strategic storage of liquid gas in tanks is under construction at Ambergate, in Derbyshire. When complete it will accommodate the equivalent in liquid form of about 250 Mft^3 of gas, or about a quarter of the total supply for one day. The liquid natural gas will be transported to Ambergate from Canvey in road tankers. A second similar storage is planned at Glenmavis, near Coatbridge in Lanarkshire, for 1 000 Mft^3 of gas—a whole day's supply. At this site a liquefaction plant is to be built, and natural gas will be taken out of the transmission grid and liquefied on the spot.

Central control of transmission

A national control centre for the whole of the Gas Council's transmission system for natural gas is to be

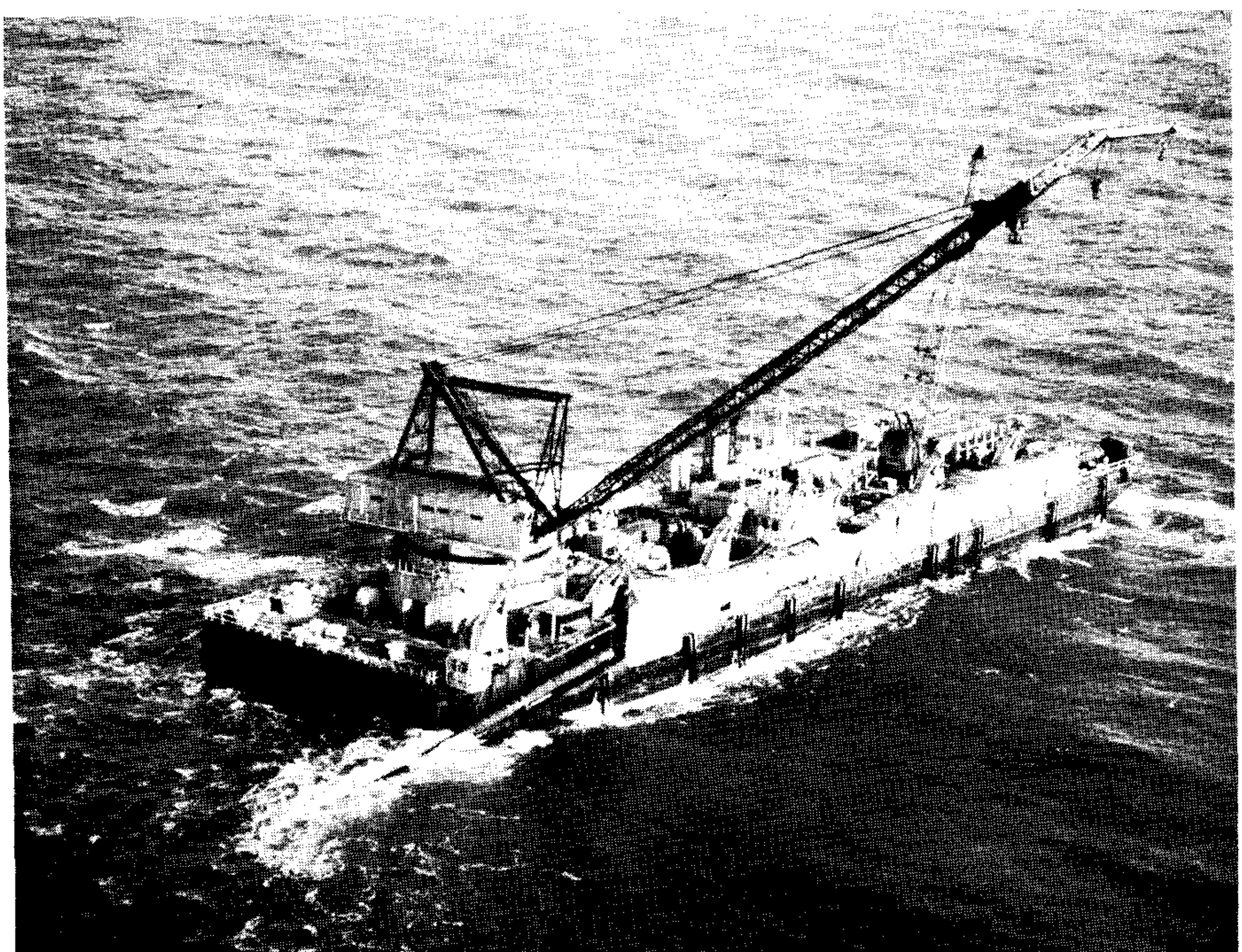


Fig. 4. 'Hugh Gorden', the pipe-laying barge which laid the undersea pipeline from the Leman Bank field to the Bacton terminal

established at Hinckley, Leics. This centre will be the focal point of the system, and will provide a method of control among the most advanced in the world. It will control and monitor the flow of natural gas through the pipeline system shown in Fig. 2, and into the Area Boards' local distribution system; it will ensure that gas is available to meet the sudden shifts in demand for gas in different parts of the country, and that the demand is satisfied in the most economical manner from the available sources of gas.

This highly complex system requires a communication network which provides maximum security. Plans have been drawn up by the Gas Council for a microwave-radio system for communication and for control of the flow of gas through the pipelines. This will give a fully automatic, computerised control and monitoring system.

Planning permission for the Hinckley control centre was granted, and construction work started in 1969.

7 Conversion of a town-gas system to natural gas

Natural gas differs in two important respects from town gas. Firstly, natural gas has twice the calorific value of town gas—a cubic foot of natural gas produces 1000 units of heat, whereas a cubic foot of town gas produces only 500 units of heat. This property also means that a given volume of natural gas requires twice as much air to burn it completely as does the same volume of town gas. Secondly, natural gas has a low flame speed, while town gas has a high flame speed. These two properties together mean that if natural gas is burnt in an existing appliance the resulting flame is underaerated (giving incomplete combustion) and tends to lift off the burner (so giving an unstable flame). Every existing gas appliance must therefore be converted before natural gas can be fed directly into it.

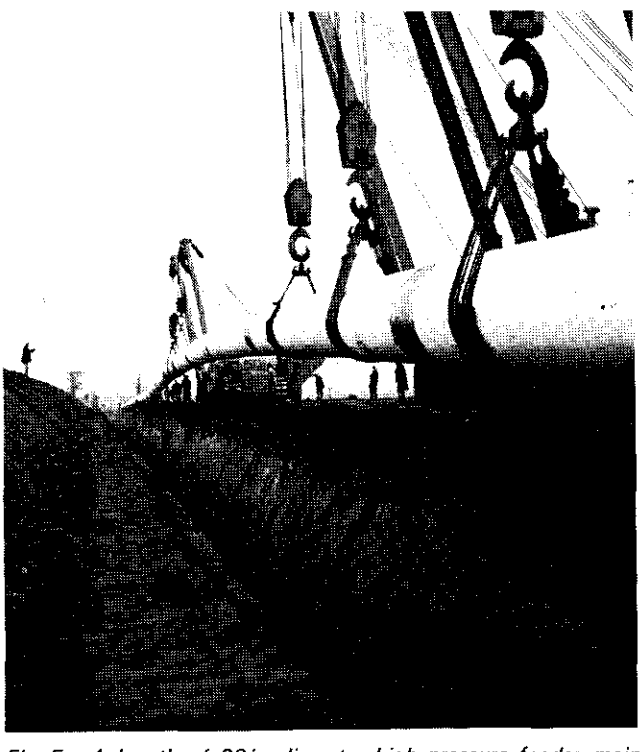


Fig. 5. A length of 36 in diameter high-pressure feeder main being laid

The operation of converting whole towns and cities, with their interconnecting complex of distribution networks, to natural gas is unparalleled in size. Large-scale conversions have, of course, been carried out in the United States, Canada and Europe, but this is the first time that a programme for a conversion covering nearly 13 million consumers has been faced. With an average of three appliances per consumer, this means there are some 40 million appliances now existing, each one of which has to be converted. It is obvious, therefore, that this cannot be achieved at once, but must be carried out piecemeal over a period. It is estimated that conversion of the whole country may take as long as 7–10 years. However, the natural gas from the North Sea will continue to be used as it becomes available, in the same way as the Algerian natural gas is now used; i.e. it will be processed in the new plants to make town gas. However, sector by sector within the Area Boards the new gas will progressively be supplied direct to the consumer as conversion proceeds.

The cost of this huge conversion will be about £400 m., and this cost will be met by the industry, *not* by the consumer. It is reasonable to ask why this costly conversion is necessary, since, as has been seen, natural gas can be processed to town gas and thus be used in appliances without conversion. These are three reasons why the Gas Council believes this to be the wrong way of using natural gas:

(i) The processing of natural gas to town gas costs money to build and run the plant; so the price of the gas to the consumer must be higher than it would have been if the plant were not there.

(ii) The thermal efficiency of the process is only 90%, so that 10 out of every 100 therms are lost which would not be lost if the gas were supplied direct.

(iii) Because the calorific value of natural gas is double that of town gas, a given volume in a pipe contains twice as many therms as would the same volume of town gas. In other words, the passage of natural gas through a distribution system automatically doubles the capacity of the system. Without this doubling, a further programme of extra mains laying within a very short time, and costing many times the cost of conversion of appliances, would be required to keep pace with the expansion of the industry's business. This would lead to rises in the price of gas to the consumer.

8 Conclusion

The potential advantages of this indigenous natural gas to the country's economy are enormous. 2000 Mft^3/day of gas is equivalent to 15 Mton/year of oil, and by 1980 natural gas could account for some 20% of the total national energy requirements. The discovery of natural gas under the North Sea could well change the fortunes of the nation.

Attempts to compare different manufacturer's equipment are always confused by the problem of persuading the companies concerned to provide specifications in similar terms. The specimen description of a standby diesel electricity generator given here is an attempt to provide a useful standard form, which, it is hoped, will enable engineers to 'tie down' manufacturers to the essentials. While it has been prepared by a well-known manufacturer, which may tend to negate its force, it is suggested that, in practice, any departures from the points of this specification should be carefully studied. Comments on this exercise would be welcomed.

SUGGESTED SPECIFICATION: Standby diesel electricity-generating plant

General

The following specification covers the manufacture, supply, delivery and installation of automatic standby diesel generating equipment. The unit should comprise a water-cooled engine flexibly coupled to form a monobloc unit to a brushless alternator, the two machines being mounted inline on a combination steel bedplate and provided with suitable antivibration mountings.

Control and protection

The control and protection of the generating set shall be by a solid-state control system utilising integrated circuits on a 5 V regulated power line obtained from the 24 V d.c. supply. The method of construction is such that complete sections of the logic control system may be withdrawn for inspection. The whole system shall be self-contained inasmuch as the switches, indicators, push-buttons and logic controls are either mounted on or in a module section having overall dimensions of approximately 18 × 10 × 8 in.

The control system shall consist of the following modules:

contactor control (mains)
contactor control (alternator)
mains detection
power supply
d.c. control
alternator
protection (1st unit)
protection (2nd unit)
alarm and miscellaneous section

The only remaining moving equipment allowed are the changeover contactors and the drive arrangement.

The system shall incorporate silicon transistors, diodes and integrated circuits and shall be assembled in a compact panel. The complete system shall be designed so that changes may be made by replacing the modules. For example, if additional equipment is required after installation, the module which would normally incorporate the extra feature required can be unplugged, and a new module incorporating the required extra, can be inserted.

The equipment shall be complete with auxiliary items including fuel and exhaust systems, engine-cooling equipment, and would consist of the features given below.

Engine

Of the type..........................with..........................cylinders, water-cooled diesel engine, governed to operate at a speed of 1500 rev/min and capable of developing....................bhp when operating under normal temperature and pressure conditons. In addition to the above, the engine must also be capable of providing a 10% overload for a period of 1 h in any consecutive 12 h period.

Engine accessories

The engine shall be provided with the following:

Pressurised system thermostatically controlled with bypass and with engine-driven water pump.
Enclosed-flow feed lubrication system by gear-type oil pump from engine oil sump.
Fuel- and lubricating-oil filters with replaceable elements and pressure bypass.
Engine instrument panel containing:
oil-pressure gauge
oil-temperature gauge
water-temperature gauge
combined tachometer and hours recorder.
air-inlet manifold and filter
engine-mounting feet
fuel-injection pump with mechanical governor capable of controlling the engine speed in accordance with BS 649: Class A
industrial heavy flywheel
oil-temperature stabilising unit
flywheel housing
instruction book
spare-parts manual
standard tool kit

Engine cooling

The engine, being water-cooled, shall be cooled by means of an engine-mounted engine-driven radiator, complete with pusher-type fan and fan drive. The driving belts must be enclosed in a wire-mesh guard to prevent contact with the driving belts during running periods.

Engine ducting

The radiator shall be fitted with a flange to enable ducting to be attached in a way suiting the engine-room layout. A flexible section shall be supplied between the radiator and ducting.

Engine starting

The engine must be so arranged to be started by means of an axial starter engaging on a toothed gear ring on the engine flywheel.

Starter battery

Include for the supply of a heavy-duty lead–acid engine-starter battery, 24 V d.c., to start the diesel engine and feed the d.c. control circuits. This must be large enough to operate six starts, one after the other.

Battery charging

To maintain the battery in a continuous state of operation, a solid-state battery-charging unit shall be supplied, which will automatically adjust the charging rate to suit the state of the battery. This charger shall be connected in the maintained supply of the unit.

Engine-protection devices

The engine must be fitted with suitable control switches, which will automatically shut down the engine in the event of a low-oil-pressure or high-water-temperature fault occurring.

Alternator

The alternator is to be brushless, screen protected, fan ventilated and dripproof, constructed and continuously rated in accordance with BS 2613, and capable of giving the required output at 415/240 V, 3-phase, 4-wire, 50 Hz, when running at 1500 rev/min. It must be supplied with a voltage regulator capable of controlling the output voltage to within $\pm 2\frac{1}{2}\%$ from no load to full load at any power factor between 0·8 and 1·0.

Bedplate

The diesel engine and alternator shall be flange mounted inline on a combination steel bedplate fitted with raised *machined* pads for the mounting of the diesel engine and alternator. If the unit is rated at over 100 kVA, the bedplate must be stress-relieved. The complete unit will then be mounted on one set of antivibration mountings, designed to match the unit.

Control panel

The control panel is to be free-standing and floor-mounted, manufactured from sheet steel, and provided with removable covers to facilitate inspection of its components. Mounted upon the front panel shall be the following:

voltmeter; 3 in scale; MI flush mounting (pivotless)
ammeter; 3 in scale; MI flush mounting (pivotless)
voltmeter selector switch
ammeter selector switch
battery-charging ammeter, 2 in scale, flush mounting
solid-state control unit incorporating the following:

module (*a*)*:* amplifying the logic signal voltage obtained from the mains-detection module to a power capable of switching the coils of changeover contractors

module (*b*)*:* as detailed for the contactor control covered by module (*a*).

module (*c*)*:* monitoring the mains-supply voltage and giving out a logic signal on either a reduction or total failure on any or all three phases. Failure voltage −5% to −20% and return voltage −3% to 15%. A transient delay timer shall be provided to delay the signal from the mains detection with both 'on' and 'off' having a delay of between 500 ms and 10 s. Engine run-on timer facilities should be incorporated after the contactors have changed over to delay the stopping of the engine, this delay being variable up to a maximum of 15 min. 'Mains-within-limits' and 'mains-out-of-limits' indicating lamps must be provided

module (*d*)*:* providing the stabilised power requirements for the control system. It must maintain the logic supply voltage during all normal conditions to which the diesel engine, starter motor and batteries are subjected. The system should have a 24 V negative earth floated at 27–28 V and capable of boost to 31 V. The maximum voltage to be applied would be 32 V. The maximum transient dip is 14 V, with the minimum motoring voltage of 18 V. A d.c. on/off switch must be supplied.

module (*e*)*:* providing all the normal d.c. control functions,

1 automatic start and run
2 automatic stopping
3 hand/automatic selection
4 'stop'/'start run' selection
5 starter-motor power switch
6 stop solenoid power switch (fail to start timer)
7 fail to start system (protection delay timer)
8 stop timing system
9 protection delay timer (fail to start indicator)
10 speed sensing for starter-motor removal.

A starting-cycle timer should be provided which will switch the starter-motor switch on and off to provide multiple starting attempts.

module (*f*)*:* providing a signal output for the control of the alternator contactor

module (*g*)*:* low-oil-pressure and high-water-temperature shutdown, complete with lamp indication. Alternator overload, detected by magnetic dashpot, and overspeed, by sensing equipment, shall be incorporated with lamp indication

module (*h*)*:* left as a spare module for extra fittings as detailed at the end of this specification *module (i):* giving audible warning of any fault at any of the modules. A power-output switch will be provided for remote audible alarm.

Mounted within the control panel shall be the following:

- one set of auxiliary fuses
- one alternator-overload unit
- one solid-state battery-charging unit
- one set of current transformers
- two contactors, triple-pole type, one for the mains supply and one for the alternator supply, each mechanically and electrically interlocked

The control panel shall be complete with all indicating labels, terminals and main and auxiliary p.v.c. wiring, and its inside should be finished in white enamel to ease maintenance.

Fuel system

A daily-service fuel tank having a capacity allowing the diesel engine to run on full load for eight hours shall be supplied. This must be suitable for wall mounting or to be mounted on a fuel stillage, depending on its weight. It must be fitted with inlet and outlet connections, breather, sludge drain and contents-level guage. Automatic fuel transfer and low-fuel indication should be offered as optional extras.

Finish

The steel baseplate shall be cleaned and inhibited against rust, and given priming and etching coats before assembly, and the completed plant should be primed and etched before given two final coats of oilproof enamel paint. All warning labels should be fitted *after* painting.

Installation Materials

The following installation materials must be supplied:

- one primary exhaust silencer
- one terminal exhaust silencer
- one flexible section
- one set of exhaust piping of suitable size to suit the layout of the engine room
- one set of fuel piping
- one set of hangars, brackets and sundries to complete
- one set of p.v.c. main cabling from alternator set to control panel
- one set of logic control cables from alternator set to control panel
- one set of d.c. power cables from alternator set to control panel
- lengths of all cabling to suit engine-room layout.

Important

Please note that you do not include for lubricating oil or fuel oil, or for acid for the batteries. The customer will supply these.

∗ Members Diary ∗

MEMBERS' DESIGNATORY LETTERS

It is noticed that some Members of the Institute are still using the letters ' M.I.H.E.' after their names, in, for instance, The Hospitals' Year Book, and elsewhere.

The letters I.H.E. denote membership of the Institution of Highway Engineers. The proper designatory letters, I.Hosp.E., for use following Incorporation were indicated to members at the time of the Grant of Incorporation. They appear in Article 26 of the Articles of Association which have been distributed to every member, but for ease of reference they are quoted again here.

Companion	C.I.Hosp.E.
Honorary Member	Hon.M.I.Hosp.E.
Full Member	M.I.Hosp.E.
Associate Member	A.M.I.Hosp.E.
Graduate	Grad.I.Hosp.E.
Student	Stud.I.Hosp.E.
Associate	Assoc.I.Hosp.E.

Members are requested to ensure that the proper letters are used after their names at all times.

NEW FACES

Mr. T. S. Elstub, who was formerly the Group Engineer, Nottingham 4 HMC, has now been appointed Deputy Group Engineer at the Trent Vale HMC.

Mr. D. E. Holloway has moved to the same HMC as Group Engineer. He was recently Site Engineer, Sheffield RHB, and formerly Acting Group Engineer, Leicester 3 HMC.

∗ Among the Branches ∗

YORKSHIRE BRANCH

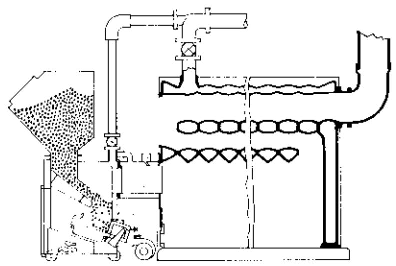
Twenty-four members of the above branch visited the works of Chas F. Thackray Ltd., Surgical Instrument Engineers and Manufacturers, on the evening of the 27th July 1970. Members were met and welcomed at the works by Mr. R. H. D. Hood and three members of the staff, who acted as guides for the occasion.

Members were shown during the tour the many processes used in the manufacture of sterilisers, operating-theatre tables and parts used in the treatment of arthritis of the hip. At the end of the tour, Members were entertained to buffet refreshments, and the Vice-Chairman, Mr. A. L. Sykes, moved a vote of thanks on behalf of all present for a most interesting and entertaining evening.

Did you know that coal, mechanically stoked, is 'smokeless'? The Gas Industry is closing down its coal-based gas works so production of gas coke will drop. But do not let this leave you in the cold next winter. Take advantage of the situation and convert to automatically stoked coal.

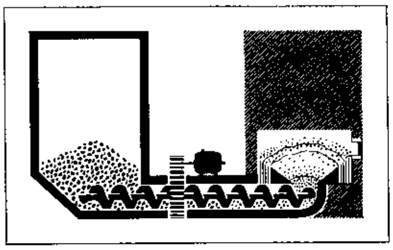
* You can buy it for half the price of the coke you use now.
* Mechanically stoked, your boiler efficiency will be 50% more than it is on handfired coke.
* Your heating standards will go up because the fire will be automatically controlled. This means a guaranteed prompt start after the weekend and in the mornings.
* Less storage is required and coal can be delivered much more easily than coke.
* It will give your present boilers a new longer lease of life. Other fuels with high operating temperatures cause quick deterioration in old boilers and mean expensive replacement. With solid fuel you can keep them happy and comfortable for years to come.
* Conversion to coal is swift and uncomplicated: many heating plants can be changed over in a weekend.
* The NCB will give you supply contracts as a special assurance of regular supplies in the future.

Some of the ways to convert from Coke to Coal



Pre-burner. Using the gravity feed principle, this newly-developed unit enables existing sectional boilers to switch from coke to coal with only minor modifications and no extensions of plant. A connection to the flow and return pipework, and a 5-amp electricity supply, is all that is necessary.

Gravity Feed. A fuel hopper automatically feeds fuel to the firebed, where air is forced in to provide almost total combustion. Removal of the small amount of clinker left by this method, and re-filling of the hopper, takes only a few minutes each day. For large installations, automatic hoppers are available.



Underfeed. This method permits the use of the cheapest grades of coal, fired smokelessly. A rotating screw feeds the fuel into the firebed from below. Forced air pushes the volatile gases through the firebed for virtually total combustion. Labour requirements are less – with automatic control available to reduce them further.

NCB

When you're making a change, coal is a change for the better.

For further information, write to or telephone your local NCB Regional Office (the address is in the telephone directory).

CONFIDENTIAL BULLETIN FOR THE USE OF MEMBERS

THE HOSPITAL ENGINEER NEWS LETTER

The Institution as a body is not responsible for the statements made or opinions expressed herein.

Issued SEPTEMBER 1945

No. 1

Contents

Hon Editor :
R. G. ROGERS,
"Elmfield,"
Stone,
Aylesbury,
Bucks.

EDITORIAL.

IT is with very great pleasure that your Council present the first edition of the "Newsletter," and it is with even greater pleasure, that, even as these lines are being written, we hear the news the whole civilised world awaits, that "the unconditional surrender of Japan, the last enemy, is iminent." It is to be hoped that this "Newsletter" will therefore be born in an atmosphere of peace and that this condition may endure for all time, so that Engineers everywhere may devote their skill and scientific knowledge to devising, producing and maintaining equipment beneficial to mankind, instead of the destructive munitions of war, which, for the past six years at least, we were reluctantly forced to produce, in order to counter and overcome the hideous devices conceived by the world's war lords, and to preserve the life and liberty of humanity.

It is close on two years since the Institution was first constituted, and during the greater part of this period, efforts have been constantly made to produce a "Journal" or "Newsletter." With this object in view, your Council appointed a sub-committee consisting of Mr. J. Hargreaves, Chief

Quarter century!

How many readers remember the first-ever regular publication of the Institution of Hospital Engineers? It was a printed newsletter, and first came out 25 years ago this month, about two years after the formation of the Institution itself. As can be seen from the front page, shown opposite, the hospital engineers then were just turning from the realisation that the horrors of war were behind them, and beginning to think of what the future held. The Institution had been trying since its inception to start publishing a journal of some kind, but this was not possible for many reasons—not least the paper shortage. When the efforts eventually had some effect, engineers were full of the progress that could be made in improving the hospital service. In addition, with the Institution in its infancy, they wanted desperately to see their conditions of service and status rise to a level which at that time could only be a dream. They recognised that for some time they would have to 'make do'—resources would surely soon be available, but no one expected them tomorrow.

It was in this climate of optimism and determination that 'The Hospital Engineer' was born, with the aim of improving the knowledge and the standing of hospital engineers, and to help give Britain and the world the best that could be obtained in the hospital field. To quote from an article in Number 1: '. . . will you help your Council, by making known to any other eligible engineer, what we have set out to achieve, and do your utmost to persuade him to join the organisation which has his interests at heart?'

Well, how far have we gone toward these two goals? The Institution (which is now the Institute of Hospital Engineering, recognising the part played by engineers and designers outside the hospital service) now has a monthly journal, and it contains perhaps five times as much material each month as the newsletter had less frequently. The membership is around the 1500 mark, and growing, but slowly.

Perhaps it is only the idealism and unity of a country at war that can give such an organisation an impetus. Creating the Institution and starting a journal were two giant steps forward, which perhaps could hardly be equalled. But has the Institution really achieved anything since then? And what should it be doing now, to achieve more, to contribute more to the peaceful (?) world for which its founders longed? Perhaps the readers have their dreams, maybe members have their private hobby horses. But maybe the dreams have all come true, and the hobby horses overtaken by reality. Or is it that, the dreams being more comfortable than reality, we have gone into a permanent doze, occasionally mumbling faintly when the world comes uncomfortably near, but usually turning over and pulling the blankets closer round our ears?

Are the readers of *Hospital Engineering* idealistic sheep, apathetic goats, or some more interesting species? In the November issue perhaps we could have two pages devoted to '25 years of achievement' and 'The next 25 years of achievement'. Please write with your experiences, hopes and complaints, and let us see if the whole thing really is a worthwhile affair.

Originally published in 'Answers', 15th August 1942. Reprinted in The Hospital Engineer Newsletter, No. 1, September 1945

Before any reader goes rushing for pen and vitriolic ink, perhaps it should be pointed out that even in 1945 this piece was not intended to be taken as exactly representative of the hospital engineer's role. Nevertheless, it did bring down a certain amount of written and verbal wrath upon the then editor, who was brought, in the following issue, not to apologise, but at least to attempt to placate his critics. With this in mind, the article is now reprinted with the justification of 'historical interest'.

'Send for the Engineer'

Doctors, nurses, and patients know they can depend upon the hospital engineer in any emergency

What do you connect with hospitals? Doctors, nurses, drugs, pain, relief, X-ray? Have you ever thought of engineers? No? Well, they are most important. And like the doctors and nurses, their job is a 24 hour one.

For some time, when night brought the bombs to London, I worked at a well known hospital, and later, at another, I was one of the victims. I learnt a little of this unknown quantity—the engineers—and how to appreciate their services.

It seems that all big hospitals have a slogan used extensively when in doubt: 'Ring for the engineers!'

The patient in bed 6 has a castor off his bed. Send for the engineers! One comes with a bag of tools. (Great interest displayed by fellow patients.)

'And as you're here, I think there is air in this radiator.'

'Yes, nurse, I'll see to it.'

From a small room between two big wards a nurse emerges. Do you hear her words? 'I'll get the engineer. The tall one knows a lot about radio.' Somewhat lengthy pause and a tall man arrives with a piece of flex in his hand. A 'Houseman' on his round stops him.

'Did you look at that bell lamp? It flickered unceasingly during a dressing this morning. Ask nurse to give it to you.'

'Certainly, sir.'

All is quiet. Later a subdued scream from the kitchen pierces the air, unheard, of course, by the patients! A rustle of starched apron and someone goes to the telephone. Minutes pass. The engineer appears, a trifle annoyed because he was attending to the furnace down below.

'Oh! You've come. It was a mouse! It ran right across my foot as I was boiling the milk.'

With just a hint of a sour expression, the engineer goes down on his knees—mouse hunting!

Very often it is more serious. Someone is very ill and oxygen is being given. The cylinder is empty and the new one (almost as big as the small nurse managing it) has a screw she cannot undo. Her junior is called.

'Ring for the engineer and ask him to come immediately.'

He comes, with a spanner in his pocket, and very soon the cap is loosened and the cylinder in position.

The operating theatre is, of course, any germ's idea of Hell! Everything is so clean, so scrubbed. Linen, towels, gowns, masks and instruments are all sterilised. The steriliser, in which the instruments are boiled, is a most precious object and, though nothing remotely connected with panic or flurry is ever known in a hospital, the steriliser 'going wrong' brings the theatre staff very nearly to tiptoe.

By now you know the solution. 'Send for the engineers.' This time they hurry. The gravity of a steriliser out of order is not a matter for dawdling.

Now and then something very delicate occurs. An instrument slips down the drain! Invariably it is 'Mr. X's favourite scalpel!' Engineer with a large bag of every known tool arrives and is prepared to be humorous.

'Hands like feet, nurse? Can't hold anything! What blinkin' thing is it this time?'

A lengthy performance follows with the engineer trying a variety of tools. (It is rumoured in a certain hospital that the engineers of a rival establishment, on being called to attend to a blocked drain, pushed and panted for some time and eventually fished out—a patient! This episode is firmly denied by the hospital concerned!)

But of all the trials calculated to bring grey hairs to engineers, that of the black out must hold first place. Hospitals with their many and large windows are extremely difficult to blackout, and policemen, wardens, firemen and friendly passers by all pop in with: 'Sorry! Light showing.'

Unending struggles by sisters and nurses, with advice from patients given freely, are of no avail. The engineers come, with patience only slightly strained. They look, finger the blinds, run their hands over the strips of black paper along the window edges, mutter to themselves (I imagine very powerful words), and finally clamber up a ladder, adhesive tape in hand, and 'stick the ruddy blind to the window frame!'

Don't forget the engineers! They are always willing, cheerful and helpful. At any hour of day or night they come to answer a call, big or trivial.

I verily believe that, if anything happened to the engineers, the whole hospital would be sunk in gloom!

First International Congress of Hospital Engineering

This Congress, held in Rome from the 11th–16th May 1970, was attended by the President of the Institute, Mr. G. A. Rooley, and Mr. G. S. Gillard, a Member of Council. The delegation from Great Britain was the largest from overseas; it was led by Mr. John Bolton, Chief Engineer, Department of Health & Social Security, and included 12 Regional Hospital Board Engineers, among whom were two further Members of Council of the Institute, Mr. K. J. Eatwell and Mr. B. A. Hermon. Representing the Scottish Home & Health Department were Mr. A. Wotherspoon, Assistant Chief Engineer, and two Regional Hospital Board Engineers, Mr. W. Russell and Mr. K. W. Wilson.

The Congress, organised by the Federazione Italiana Technic Ospedalieri (FITO), was opened by the Under-Secretary of the Ministry of Health of the Italian Republic, which sponsored the Congress, Dr.Ing. Oswaldo Amato, President and General Secretary of FITO, and Dr. Raffaele Bernadini, Vice-Secretary of FITO.

On the first two days technical papers were presented on kitchens, laundries, electronics, industrialised building and automation, with contributions from several countries.

The third day was the 2nd National Congress of the Italian Federation of Hospitals Technicians, to which the representatives of the Institute of Hospital Engineering were specially invited, at which the President conveyed the greetings of the Institute and the British delegation to our Italian colleagues.

In his address Mr. Rooley said that the Institute of Hospital Engineering was very much in favour of the proposal to form an International Federation of Hospital Engineering, and that he hoped the next Congress could be held in London in 1972.

Following the President's address, Mr. Gillard presented a paper entitled 'The training of engineers in the National Health Service of Great Britain'. (This paper appeared in the June issue of *Hospital Engineering*, together with the papers presented later in the week by Mr. Bolton and Mr. Joseph.)

The final three days were devoted to the presentation and discussion of reports on the following subjects:

the development of hospital building and technology all over the world

hygiene and the improvement of conditions in hospitals

technicians and hospital activities.

During the week, some of the delegates visited St. Peter's Basilica to attend a Papal Audience, when the Holy Father particularly mentioned the Congress, including the British delegation, and blessed the important work it had met to perform.

At the closing session of Congress a general motion was passed expressing the views of the Congress on the part to be played by engineers in the three subjects mentioned above. The motion is reproduced below:

General motion

The participants at the first International Congress of Hospital Engineering have heard general reports, the reports of the delegations representing Canada, France, Japan, Great Britain, Greece, Portugal, Sweden and the Soviet Union, reports of the Italian Administration, and also of the speakers who intervened.

As far as the first subject of the Conference is concerned, i.e. 'The development of hospital building and technology all over the world', having defined the existence of considerable differences in the notion of the functions of the hospital organisations, and of the technical standards, between the various countries of the world, the delegates

(*a*) expressed the wish that all technical activities connected with hospital technology and construction will be developed within a frame-work of mutual technical and cultural exchanges at international level

(*b*) expressed the hope that the Congress Proceedings will be received by the national and international bodies which will provide adequate instruments of operational co-ordination in the various countries

(*c*) announced the setting up of a new international organisation for the development of hospital technology. The International Federation of Hospital Engineering has been declared.

As far as the second subject is concerned, i.e. ' Hygiene and the improvement of hospital conditions', having noted the need to adopt the most modern integrated systems using highly specialised installations, equipment and technicians in the hospital technological field, the delegates expressed the wish that organisational systems which meet the demands of modern technology be created for all activities from programming to management, so that the Health Services will be in line with the evolution of social requirements and will themselves be managed in the most efficient manner through:

(i) a network of Health Services within an integrated system of social services and town planning

(ii) the introduction of the principle of progressive care and home treatment

to lead to the final objective of centralisation and management of the health data of the entire population, both for therapeutic treatment and preventative purposes.

As far as the third subject is concerned, i.e. ' The technicians and hospital activities ':

(i) It has been determined that the co-ordination of the technical functions has been insufficient, and the participation of the technicians of various levels in the carrying out of the hospital management works has been agreed as being essential.

(ii) It has been determined that the technology of the hospital sector needs to be brought up to date and greater emphasis based on interdisciplinary co-operation.

(left to right) Mr. B. R. Joseph, Senior Engineer, Department of Health & Social Security, Mr. J. Bolton, Chief Engineer, Department of Health & Social Security, Dr. R. Bernardini, and Mr. G. A. Rooley, President, Institute of Hospital Engineering

(iii) It was asked that the role of the hospital technician should be officially recognised, together with his autonomy of action in the field of engineering and scientific research on a large territorial scale.

During the week a number of informal meetings had taken place between the Institute's representatives and members of similar societies from other countries, and the last motion passed by the Congress was that there should be formed an International Federation of hospital engineering. The objects of the Federation are contained in a statement which was signed by the representatives from Great Britain, Italy, France, Greece, Portugal and Sweden, which is reproduced below:

International Federation of Hospital Engineering

The Federation's objectives are:

(*a*) to promote, develop and disseminate hospital-engineering technology

(*b*) to compare international experience

(*c*) to promote more efficient planning and design of hospital-engineering installations and equipment

(*d*) to promote more efficient operation, maintenance and safety of hospital-engineering installations and equipment

(*e*) to collaborate with other International organisations.

Membership is confined to national associations of hospital engineering, but the Council shall have discretion to admit one representative from countries which do not have national associations. The founder members are:

The Institute of Hospital Engineering (UK)

Association Nationale des Ingenieurs Hospitaliers (France)

Federazione Nazionale Tecnici Ospedalieri (Italy)

Technikon Epimeliterion Ellados (Greece).

The following representatives of the main national associations were required to prepare the Articles of the Federation to be submitted for the approval of the Council within the following six months:

Mr. John Furness (UK)

Mr. Henri Alloy (France)

Mr. Bruno Massara (Italy)

Mr. Zisimos Tzartzanos (Greece)

Mr. Jan Thorp and Mr. Eduardo Caetano are invited, as representatives of Sweden and Portugal, to co-operate with the above named.

The Institute will now play an active part in preparing the Articles of the Federation, and will investigate the practicability of holding the 2nd International Congress of Hospital Engineering in London in 1972.

THE ROLE OF TRAINING IN JOB PARTICIPATION

BY ALAN JONES, Dip.Ed., M.I.P.M., A.M.B.I.M.

Now that Falfield is off the ground, as well as Keele, we should be examining the effect of engineering and management training at these centres. Evaluation of training is a matter that concerns training managers very deeply. Some facets of training are easily evaluated —operator training, for instance—but others are not, and despite the availability of some reasonably sophisticated evaluation techniques, it is still difficult to assess accurately and subjectively the benefit to be had from any formal course of training.

Evaluation can best be measured if something positive happens as a result of a training experience. In other words, what precisely happens back on the job is the only true guide to training effectiveness. If training experience is not put into effect on the job, then its value, effort and cost will all have been to no avail. It is the manager's responsibility, therefore, to ensure that the maximum effort is allowed for in the implementation of the new techniques acquired by his staff from their attendance at courses. Staff must be allowed to feed in their ideas and to practise their newly acquired knowledge and techniques. This is the very hub of any process of evaluation of a training experience.

Use of resources

The world of hospital engineering is nowadays so complex that no one man can hope to know and implement every conceivable facet of modern engineering practice. The manager, whether he be the group engineer, the hospital engineer or the building supervisor, must ensure that he uses his total resources to achieve the best possible effect His resources are many, but there can be no doubt that his most important resource is that of human endeavour. The sum total of knowledge and technical skill held by this human resource must be used to the best possible advantage.

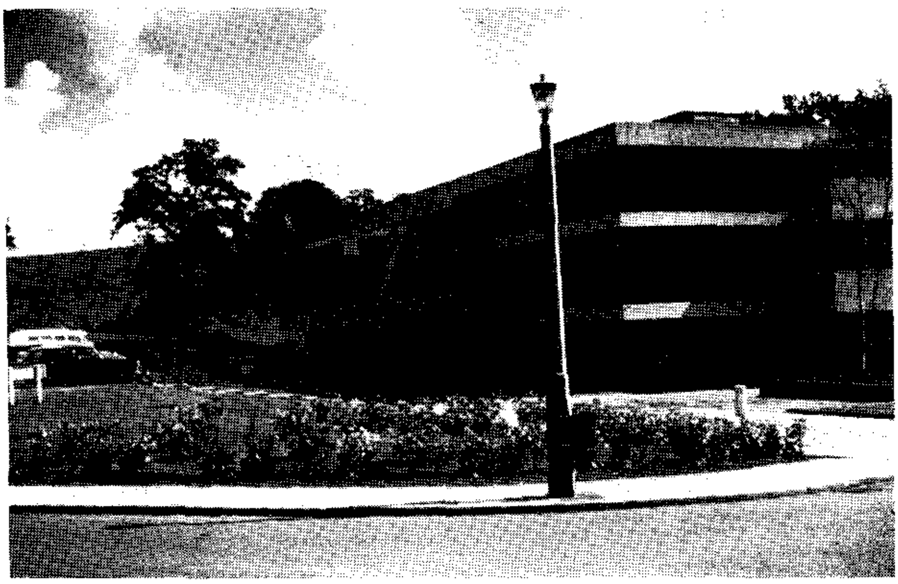
Much has been said and written about job satisfaction in recent years, and in many instances a great deal of idealistic theory has been written. If job satisfaction is to be enjoyed by everyone on the manager's staff, then it is the manager's responsibility to provide the climate in which job satisfaction may be acquired. Exceptional

Mr. Jones is Regional Training Officer, Liverpool Regicnal Hospital Board. He has been a course tutor on Keele courses for a number of years, and this year is a member of the course committee which determines course content and training procedures

organisation of the job, a realistic allocation of the human resources to meet the job, and a fair deal for the men, all contribute to providing job satisfaction, but they are not sufficient in themselves to provide it. The best possible climate for creating job satisfaction is that in which the men are allowed to participate in the total effort of the organisation. There should be free discussion between the manager and the men on how best the job can be done, which methods are the most suitable and, most important of all, recognition by the manager of the technical knowledge held by the men who are to do the job. It is this kind of participation which ensures a high morale on the part of the men; obviously, where morale is high, productivity and quality of work will also be high, and the men will derive an intense job satisfaction from the participative process.

It would be almost futile to send staff to the Falfield and Keele courses if there were no dialogue beforehand between the manager and the course member. Similarly, feedback after the course is essential if the maximum value is to be gained from the training experience. The manager, therefore, should discuss fully with his staff the aims of the courses, their content, the new updating technology and the methodology to be used, before they set off on a course. Immediately after their return, discussion should take place on what has been learned, what new skills have been acquired (if the aim of the course was to teach a skill), and an early opportunity should be provided for the application of the newly acquired techniques, with additional feedback on this application in a true working situation.

It is this free and open discussion at all stages that will ensure the strength and success of the Falfield and Keele courses. It would be futile to set up a terrifically expensive national engineering-training centre such as Falfield if managers do not take the opportunity, from the active participation by their staff, of updating their own technical knowledge and management skills.



Students' Union Building, Keele University

Human dignity

The hospital service is a labour-intensive industry; i.e. the maximum portion of expenditure is given to salaries and wages. Something like 72% of expenditure is staff cost, and consequently we should constantly endeavour to make the best possible use of the human resources at our command. If the organisation is to be successful, the potential of its human resources must be fully realised and released at maximum efficiency. This can only be achieved through participation and an understanding of human dignity. A true realisation of this will ensure that men behave more responsibly in their work, and their involvement through sensible participation will ensure greater satisfaction in their work.

Present-day costs of plant and machinery are well-nigh prohibitive. Care and maintenance of highly sophisticated equipment demand the highest skills in an age of vastly changing scientific technology. Keeping engineers and craftsmen abreast of technological development is a constant training problem; hence the wisdom of creating an establishment such as Falfield. It is important that those who are to keep the engineering and management problems to a minimum are trained to do so. Then the effects of the dual-training function—engineering on the one hand and management on the other—will be given maximum scope back on the job through mutual participation.

The manager who does not allow participation on the part of his staff stands little chance of retaining his highly technical labour force. Social change has, to a very large extent, overtaken us in such a way that the highly skilled man who is not allowed to participate, and who is not consulted as to how best his skill may be utilised, will seek opportunities elsewhere. The manager then has the nagging problem of retaining his labour force. One of the surest ways of keeping staff is to set a climate in which they may enjoy job satisfaction to the fullest possible extent. This is the very essence of the nature of management today.

* Market News *

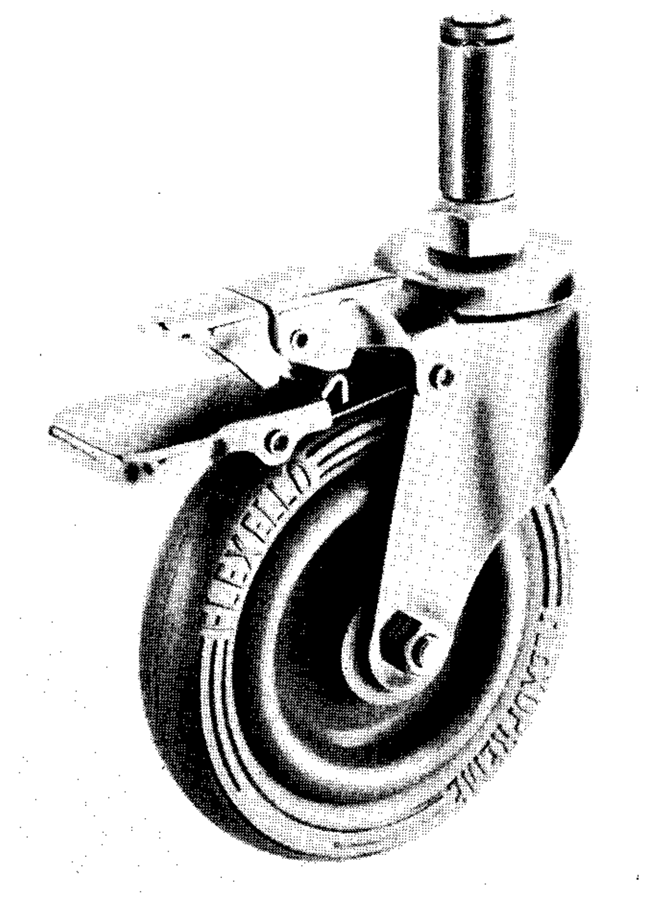
For further details, simply encircle the relevant numbers on the reply-paid postcard.

Castor

An attachment which simultaneously locks both castor swivel head and the wheel has recently been introduced by Flexello on its XL series castors. The brake is designed entirely for foot operation and is actuated by light downward pressure on the foot pedal. Release is similarly effected by means of a trip lever. The brake, which is fully adjustable, is fitted to the trailing edge of the castor fork, ensuring that the braking mechanism is always facing away from the direction of travel. There is therefore no danger of damage caused by any projection on the leading face of the castor.

The swivel- and wheel-brake attachment is available on chrome-finish castors with 5 and 7 in-diameter rubber-tyred wheels.

Flexello Castors and Wheels Ltd., Slough, Bucks. **HE68**

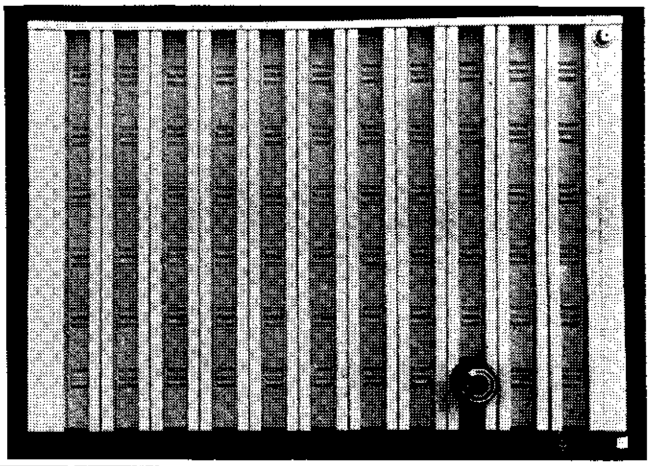


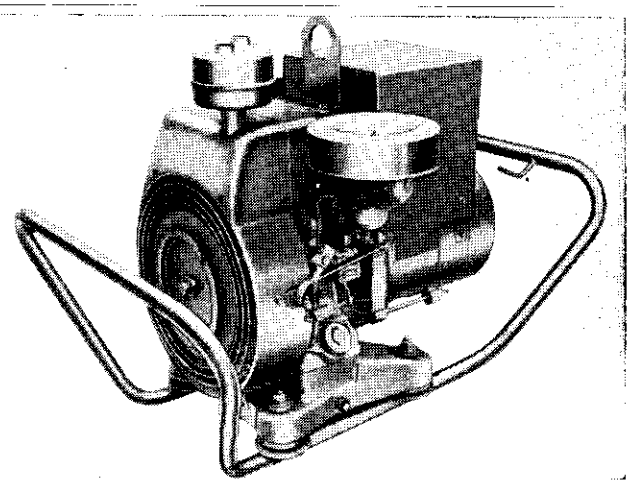
Radiator with temperature limiters

The Perrymatic Golf HE radiator is now available with an inbuilt return-temperature limit control. The limiter is fitted at the radiator outlet, where it prevents the temperature of the return flow exceeding a preset limit. This temperature can be adjusted by the knob which is used to shut off the radiator. By maintaining a reasonably constant outlet temperature, the rate of flow through the radiator will automatically vary according to the difference between radiator-surface and ambient temperatures. By allowing the water to cool to the optimum temperature before leaving the radiator, the volume of water in circulation is kept to a minimum. The action of the limiter also serves to provide a balancing function, smoothing out the pressure fluctuations frequently encountered in large heating schemes.

Perrymatic Hydronics Ltd., Chester Road, Hartford, Northwich, Ches.

HE69





Welding set

A new, portable welding set has been added to the range marketed by G & M. The Arcmaster NB has a welding range of 55–180 A at 25 V a.c. Six choices of welding current are obtained through a selector switch. All $\frac{1}{16}$ and $\frac{5}{32}$ in-diameter welding rods can be used, and most $\frac{3}{16}$ in rods, up to the capacity of the unit. The set weighs 280 lb (manual start) or 500 lb (electric start), and is powered by a single-cylinder, 4-stroke engine developing 12 bhp at 3600 rev/min. The heavy-duty alternator is directly coupled to the engine crankshaft and has a particularly stable output, permitting considerable variation in arc length. Besides its two welding-cable connections, the Arcmaster also has two plug-in receptacles for auxiliary a.c. output, allowing it to be used as a 5 kW 120/240 V portable generator.

G & M Power Plant Co. Ltd., Whitehouse Rd., Ipswich **HE70**

X ray generator

Westinghouse has produced a new general-purpose medical X ray generator with a totally solid-state design, providing high reliability and making servicing fast and inexpensive. The generator features plug-in boards for easy servicing, 24 exposure times for 0·08 to 8·0 s, and is designed for use with image-intensifier and television systems. It requires little floor space, and the cabinet front is easily removed for access to components. A meter indicates, prior to exposure, whether the tube heat limit is exceeded. **HE71**
Westinghouse Electric International Co., 1 Regent Street, London SW1

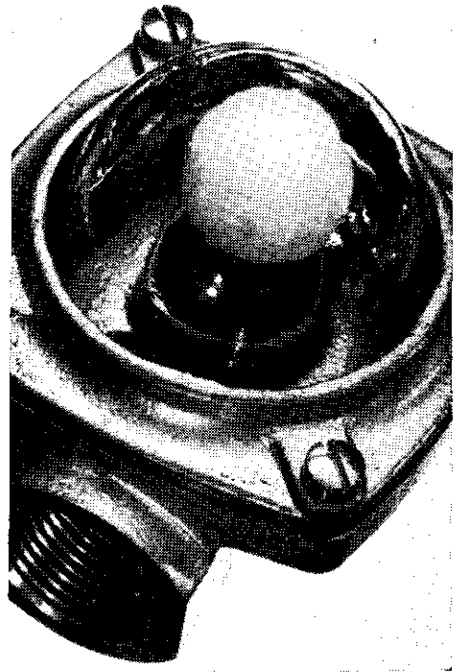
Copper-asbestos washers

James Walker & Co. is now marketing silver-coloured boxes containing an assortment of totally enclosed copper-asbestos washers. The assortment comprises 20 each of sizes $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$ in, and 10 each of sizes $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$ and 1 in.

Each individual compartment is a separate entity, and can therefore be lifted clear of the box if desired. A diagram under the hinged lid facilitates quick selection of the required size of washer.
James Walker & Co. Ltd., Lion Works, Woking, Surrey **HE72**

Ball flow indicator

A new 0·75 in ball flow indicator is intended for use with water, oil, gas or air at very low flow rates, and is manufactured in bronze. A white nylon ball dances inside the glass dome when flow is taking place, but drops out of sight if flow stops. The indicator is one of a range covering flow rates in liquids from 0·06 gal/min upwards, and in gases from 0·05 ft^3/min upwards.
Arkon Instruments Ltd., Whaddon Works, Cheltenham, Glos. **HE73**



Clippings

Readers who remember the G.E.I.S./New Scientist 'Dial-a-Computer' Competition being mentioned in this column may be interested to know that among the six winners of a computer terminal and £1000-worth of computer time was a physicist with the Medical Research Council's Air-Pollution Unit at St. Bart's Medical College. He will use his terminal to investigate connections between respiratory complaints and smoking or air pollution. The other winners will be aiming at rationalising school activities, drawing animated cartoons, classifying archeological findings, starting a one-woman home-based computer bureau and teaching children the principles of computing through playing business games, war games, cribbage and rummy. Isn't our educational system wonderful?

If you are thinking of installing a rooftop air-conditioning plant, but do not know how to get it there, take a tip from Sainsbury's. When a 3-ton air-handling system had to be installed in a distribution depot without halting production and keeping to strict hygiene requirements, they had it dropped in by helicopter. But beware; clearance had to be obtained from the Board of Trade, the local authority, and the police and fire brigade. And insurance coverage for £10 m. had to be obtained!

The latest 'perk' for assistant engineer Jim 'Puffer' McRakre is free coal—he has started an open-cast working around the hospital perimeter in his lunch hours. Questioned about his activity, Jim said dourly. 'It's nae for the coal that I'm digging, d'ye see, though I do take the black stuff away hame. It's a fence and ditch to keep the Sassenachs away—remember Culloden!'

The Institute has submitted a formal comment on the Woodbine Parish Committee report, but here are two personal views on the Committee's findings.

Another look at Woodbine Parish

There is no doubt that maintenance in general has been given a low priority on the list of expenditure for far too long, not only in the Hospital Service, but throughout the country. Building maintenance is no exception. Now the long and difficult task of the Woodbine Parish Committee has ended and the report should have been studied by all those who are interested in building maintenance.

The Committee was unable to make clear recommendations about the employment of direct labour because of the lack of reliable documented evidence. It is fairly clear, however, that where a full year's work can be guaranteed, without interruption, direct labour can be organised to compete with contractors. This is the condition that planned maintenance provides, and yet the Committee seems to have doubts about applying planned maintenance to buildings. There is evidence that it can and should be employed, and some of the best examples have been set up and implemented by engineers.

The Committee seems to have found it difficult to build a case for the proper grading of the building supervisor purely on his own job description, and have tried to achieve this by drawing comparisons with the Group and hospital engineer. Yet their responsibilities are entirely different, and certainly cannot be equated. There is a lot of difference between maintaining and operating dynamic services and maintaining static structures on which there is seldom any need to make snap decisions in order to keep the hospital going.

There seems to be no reference in the report to this Institute's oral evidence, in which it was demonstrated that in many large industrial organisations the engineer has charge of an integrated department and that there is no evidence that the building tradesmen and supervisory staff have any quarrel with this arrangement. Neither was any more than a passing reference made to the numerous modernisation schemes in the Hospital Service, undertaken from minor capital or revenue funds, which have been designed and supervised by Group engineers over the last 20 years. This is particularly true in many of the old psychiatric hospitals, where the absorption of their resources to deal with the backlog has prevented them and their colleagues from organising maintenance in the way they would have liked to have done.

It was unfortunate that both the Woodbine Parish and the Tyler Committees were left to look at building and engineering in isolation. Hospital maintenance in total is big business, not only because it is costing about £47m. a year, but because the value of the assets is probably around £3000m. This calls for a good integrated organisation with a technical man with management ability at the top. The Committee has clearly recognised this, and has recommended that a more broadly based committee be set up embracing representatives of the Woodbine Parish and the Tyler Committees before the end of the midterm period. This will be too late. The new committee should be formed now, and begin its deliberations before our maintenance staff becomes completely demoralised.

B. A. Hermon
Regional Engineer
Oxford Regional Hospital Board

Readers will by now have had a chance to read the Hospital Building Maintenance Report by the Woodbine Parish Committee, published in May of this year. The Committee was appointed in July 1968—it can therefore be calculated that this somewhat formidable 86-page document took approximately 23 months for gestation. It would be reasonable to suppose that even some of the more urgent proposals will take proportionately as long to implement.

It is difficult to disagree with many of the points raised in the report, since many of them refer to facts as they exist. Many readers will be in a position to do something about the facts in the future, and it is to this end that the following comments are made.

The Woodbine Parish Committee appears to have been hampered by its terms of reference, and even goes as far as suggesting that a further Committee should be commissioned, embracing the Woodbine Parish and Tyler Committees and supplemented by independent people, to examine the proposal for joint works departments.

A similar theme of a joint works department was also suggested in the Memorandum submitted by the Institute to the Woodbine Parish Committee and published in the June issue of *Hospital Engineering*.

Many older readers will remember that, before the inception of the National Health Service, the maintenance departments of many hospitals were headed by the combined posts of chief engineer and clerk of works, but during the past 20 years some engineers have shown a surprising lack of interest in building maintenance. As a result, some two-thirds of all hospital groups in the UK have created posts of building supervisors, some working as independent parallel departments, and others responsible to the group engineer. No group engineer is responsible to a building supervisor, possibly because only ONC is required of a building supervisor, as opposed to HNC for a group engineer.

The Woodbine Parish Committee has recommended that eventually all building supervisors should hold a HNC. This would then imply that building supervisors could well be considered eligible to hold the senior officer's post in an integrated joint works department.

Readers who view the above suggestion with horror should remember that it is of the utmost importance that joint works departments are headed by only the most capable men, regardless of their background. To obtain the best men it is necessary to provide the top financial reward and the widest possible competition, and at the same time to create a staffing structure to provide junior staff with wide experience and a distinct opportunity of reaching the most senior posts.

If the latest Green Papers become White Papers it will be essential that some definite staffing structure is formulated in the near future. The present trend for hospital Groups to amalgamate will also give hospital authorities the opportunity to reconstruct their maintenance organisations.

A staffing structure could possibly consist of an engineer–building manager who would be qualified to at least HNC in either building or engineering, with endorsement in management subjects and a wide experience in hospital maintenance.

The engineer–building manager would be assisted by a Group engineering officer and a Group building officer, each of whom would hold at least HNC in their respective disciplines and be capable of holding the senior post.

The Group engineering officer would have a staff of hospital engineers and assistant engineers, depending on the size and location of the hospitals in the Group.

Hospital engineers would be responsible for the day-to-day operation and short-term maintenance of their hospital, including building maintenance. Their staff would be qualified in predominately engineering trades and limited building crafts, and they would all be stationary crews attached to a particular hospital. There would probably be at least one hospital engineer with a mobile crew charged with the responsibility of long-term engineering maintenance, and of engineering minor capital works.

The Group building officer would have a staff of several building officers and assistant building officers responsible for long-term building maintenance, innovation and minor capital work. Their staff would be qualified in predominately building trades and a limited number of engineering trades, and they would all be mobile crews, who could be seconded to any hospital within the group.

The more important advantages of the suggested structure would be that financial resources could be divided into two fairly distinct headings: 'operation and short-term maintenance' and 'innovation and long-term maintenance'. The priorities and co-ordination would be controlled by the team consisting of the engineering–building manager with his two subordinates representing engineering and building interests.

The need for deputy Group engineer and deputy Group building officer would be eliminated, since the one senior officer would have two subordinates. Hospital engineers and buildings officers would have sufficient numbers of all types of trades to be independent of each other, but since they would all be responsible to the same head of department there would be a greater tendency to co-operate.

Since hospital engineers and building officers would be equally qualified to HNC standard, interchange could be established within the group, thus widening each man's experience. A similar arrangement would take place at assistant-engineer and assistant building-officer level, so making each man eligible for eventual promotion to the most senior post.

All of which poses the question: Is it now time for the Institute of Hospital Engineering to become associated with the Institute of Hospital Building Supervisors, or perhaps to open its doors to suitably qualified building officers?

P. Jackson
Group Engineer
University Hospital of Wales

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OFFICIAL APPOINTMENTS
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Portsmouth Group Hospital Management Committee

QUEEN ALEXANDRA HOSPITAL

Hospital Engineer

The successful applicant will be responsible to the Group Engineer for the maintenance of all engineering services at the above Hospital (512 beds), which is being rebuilt to modern district hospital standard (1000 beds approximately).

Applicants must have completed apprenticeship, with good practical and supervisory experience in mechanical or electrical engineering, and should possess one of the following qualifications [preferably (iv) or (v)], or equivalent qualification approved by the Secretary of State for Social Services:

(i) City & Guilds mechanical engineering technicians Full Technological Certificate (Part II), which must include plant maintenance and works service, or

(ii) City & Guilds Certificate in plant engineering or

(iii) MoT first class certificate of competency, which includes an Ordinary National Diploma or Ordinary National Certificate, or

(iv) Higher National Certificate or Higher National Diploma in mechanical engineering with endorsement in industrial or organisation and management and principles of electricity or electrotechnology, if this was not taken as a subject of the course, or

(v) Higher National Certificate or Higher National Diploma in electrical engineering, with endorsements in industrial organisation and management and including (at SIII or O2 level, or with endorsements in) applied heat and applied mechanics, coupled with suitable practical experience in mechanical engineering.

Salary scale: £1602 rising to £1893 per annum, plus a special responsibility allowance of £72 per annum.

Application forms and further details are obtainable from the Group Engineer, St. Mary's General Hospital, Portsmouth, and must be returned within 14 days of this advertisement.

Southport & District Hospital Management Committee
PROMENADE HOSPITAL
and subgroup
HOSPITAL ENGINEER

required to be directly responsible to the Group Engineer for the engineering services of certain hospitals within the group. Applicants must have sound knowledge of mechanical and electrical equipment, wide experience of its maintenance and should possess one of the following qualifications:

1 City & Guilds mechanical-engineering technicians certificate (Part 2) which must include plant maintenance and works service

or

2 City & Guilds Certificate in plant engineering

or

3 Ministry of Transport First Class Certificate of Competency, if it includes Ordinary National Diploma or Ordinary National Certificate

or

equivalent qualification as approved by the Minister of Health.

Salary scale £1602 rising to £1893 per annum plus £25 responsibility allowance. Whitley Council conditions of service.

Application forms available from the Group Secretary, Promenade Hospital, Southport

ASSISTANT ENGINEER

Duties at Naburn, Fulford and Maternity Hospitals (all on one site) in York. Previous applicants for this post are being considered, and new candidates should have completed an apprenticeship in mechanical engineering, have a sound knowledge of steam boiler plants with a wide experience in the management of mechanical and electrical engineering plant similar to that in modern hospitals. Applicants must hold an ONC in mechanical or electrical engineering.

Salary: £1251 p.a. rising to £1650 p.a.

Apply giving full details of age, education, qualifications and experience, together with the names of two referees, to the Group Engineer, Bootham Park, York

ST. HELIER GROUP
OF HOSPITALS
ST. HELIER HOSPITAL
CARSHALTON, SURREY

HOSPITAL ENGINEER required for the Belmont, Henderson and Sutton General Hospitals, Sutton, Surrey. Applicants should have served an apprenticeship in mechanical or electrical engineering, and hold qualifications recognised by the Department of Health. Salary scale £1734–£2037 plus £90 London weighting and £50 responsibility allowance. Whitley Council conditions of service. Application form and further particulars from Group Secretary at above address. Closing date: 21st September 1970

SENIOR SUPERINTENDENT
(ELECTRICAL)
Required by the
GOVERNMENT OF KENYA

Ministry of Works, on contract for one tour of 24 months in the first instance. Salary, according to experience, in scale Kenya Shillings 29 880–33 420 (approximately £1743 –£1950) plus an inducement allowance of £926–£956 a year paid direct to the officer's bank in the UK. Gratuity 25% of total salary drawn inclusive of generous leave or 45% without leave. Free return passages. Education allowances. Quarters at reasonable rental. Contributory pension scheme available in certain circumstances.

Candidates must possess City & Guilds Full Technological Certificate, or equivalent, and must have at least 12 year's experience (including a comprehensive engineering apprenticeship followed by at least seven years in a supervisory position) in (a) the maintenance of electrical and mechanical equipment and services and medical equipment in large modern hospitals, preferably a teaching hospital, and (b) the operation and maintenance of diesel-engine-driven alternators and l.v. and 11kV distribution systems. Officer appointed will be responsible for the maintenance of building structure and finish, hospital grounds and roads, hospital vehicles, medical equipment and electrical- and mechanical-engineering building services at the Kenyatta National Teaching Hospital, Nairobi.

Apply to CROWN AGENTS, 'M' Division, 4 Millbank, London SW1, for application form and further particulars stating name, age, brief details of qualifications and experience, and quoting reference number M2T/68111O/HR

SOUTH-WEST WALES
HOSPITAL MANAGEMENT
COMMITTEE

ASSISTANT ENGINEER

required at St. David's Hospital, Carmarthen. This is a psychiatric hospital of 1000 beds with its own electricity generating plant. Applicants must hold an Ordinary National Certificate in engineering or an equivalent qualification approved by the Ministry of Health. The successful applicant will be required to assist the hospital engineer in the operation and maintenance of the hospital's engineering services and also in carrying out other duties as directed by the Group engineer. Salary scale £1251–£1650 per annum. Whitley Council conditions of service.

Application forms obtainable from the Group Secretary, South-West Wales Hospital Management Committee, Glangwili, Carmarthen, to be returned as soon as possible

MISCELLANEOUS

South-West Middlesex Hospital Management Committee

DEPUTY GROUP ENGINEER

required to deputise for the group engineer over the whole range of duties.

The group comprises twelve hospitals and a chest clinic. The present group pointage is 72½–96 points. Salary scale £1830–£2163 per annum, plus £206 per annum special-responsibility payment. £90 per annum London Weighting is payable in addition.

Further particulars and application forms obtainable from the Group Secretary, South-West Middlesex Hospital Management Committee, West Middlesex Hospital, Isleworth, Middlesex. Closing date 26th September 1970.

ST. GEORGE'S HOSPITAL LONDON SW1

A Hospital Engineer is required for this busy Central London teaching hospital.

Applicants must have had relevant plant experience and a knowledge of planned preventive maintenance is desirable. They should possess one of the following qualifications: HNC or HND in (i) Mechanical or (ii) Electrical Engineering, each with endorsements in industrial organisation and principles of electricity or Electro Technology or Applied Heat and Applied Mechanics respectively, (iii) City & Guilds Mechanical Engineering Technicians Full Technological Certificate (Part III) including Plant Maintenance and work service.

Salary, including London Weighting and responsibility allowance starts at £1971 rising to £2274.

Exceptionally, experienced but unqualified candidates may be considered but salary would be abated by £200. Married accommodation may be available.

Apply with full details of qualifications, experience and names of two referees by 18th September, 1970 to the House Governor, St. George's Hospital, London SW1

NORTH-WEST METROPOLITAN REGIONAL HOSPITAL BOARD

CLERK OF WORKS

required to supervise the installation of mechanical, electrical and lift contracts in hospitals in the region. The person appointed will be based in the Windsor area but will be expected to travel within the region. Applicants must have served an apprenticeship in mechanical or electrical engineering and have had not less than five years' experience supervising site installations, employing trades associated with mechanical and/or electrical engineering.

Salary scale: £1289–£1745 per annum.

Application form from the Secretary, North-West Metropolitan Regional Hospital Board, 40 Eastbourne Terrace, London W2, by the 24th September, 1970 quoting reference 218

ST. HELENA GROUP HOSPITAL MANAGEMENT COMMITTEE, COLCHESTER

HOSPITAL ENGINEER

Required to be responsible to the Group Engineer for the engineering services at NOTLEY HOSPITAL, BRAINTREE (467 beds) and HALSTEAD HOSPITAL (16 beds).

Salary scale: £1602–£1893 per annum plus responsibilities allowance of £72 per annum.

In addition to having served an engineering apprenticeship, applicants must have a sound knowledge of mechanical and electrical plant, and experience of its maintenance, and possess one of the following qualifications or an equivalent qualification approved by the Secretary of State for Social Services:

(i) Higher National Certificate or Higher National Diploma in mechanical engineering, with endorsements in industrial organisation and management, and in principles of electricity or electrotechnology if this was not taken as a subject of the course

(ii) Higher National Certificate or Higher National Diploma in electrical engineering with endorsements in industrial organisation and management and including (at S111 or 02 level, or with endorsement in) applied heat and applied mechanics, provided he has suitable practical experience in mechanical engineering

(iii) City & Guilds mechanical-engineering technician's Full Technological Certificate (Part III) which must include plant maintenance and works services.

Applications giving full details of training, qualifications etc., togethe with the names of two referees, to the Group Engineer, St. Helena Group Hospital Management Committee, 14 Pope's Lane, Colchester, Essex, by the 28th August 1970

BRISTOL—SOUTHMEAD HOSPITAL MANAGEMENT COMMITTEE

Assistant Engineer required. Candidates must have completed an apprenticeship in mechanical or electrical engineering, or otherwise had practical training, and hold an ONC in engineering or equivalent. Salary scale: £1251–£1650. This post offers excellent experience.

Applications to be submitted to Group Secretary, Southmead Hospital, Bristol BS105NB

ASSISTANT HOSPITAL ENGINEER

required at Napsbury Hospital. This is a new post and will provide excellent training for a person wishing to enter the field of hospital engineering. Applicants must have completed an apprenticeship in mechanical or electrical engineering, or have acquired a thorough practical training in this field, and must have ONC in engineering or equivalent. Married accommodation available. Salary scale £1251–£1650 per annum.

Application forms and job description from the Group Secretary, Napsbury Hospital, nr. St. Albans, Herts. Closing date: 21st September 1970.

EAST BIRMINGHAM GROUP OF HOSPITALS

Chief Technician

is required at East Birmingham Hospital to supervise and lead a team of technicians and engineers in the Medical Engineering Department. Sound knowledge and experience of maintenance and development of electro-medical and laboratory or similar equipment is essential. Experience in the control and application of radioisotopes would be a distinct advantage. The successful applicant will be required to liaise with and advise medical and other professional staff and apply original thought to problems of development and application of electromedical equipment, and associated physiological measurement.

Qualifications: Degree or HNC/HND in electronics, physics or electrical engineering or equivalent. Basic salary £2070 rising to £2445 per annum.

Technician

is required at East Birmingham Hospital to assist in the maintenance and development of electromedical and laboratory equipment. Experience in the servicing and calibration of similar equipment is desired, and knowledge of control and application of radioisotopes would be an advantage.

Minimum qualification ONC/OND electronics, electrical engineering or physics. Basic salary £1356–£1764 per annum according to qualifications and experience.

Application forms and job descriptions in respect of the above posts available from: **The Group Engineer, East Birmingham Hospital Management Committee, Group Administrative Offices, 45 Bordesley Green East, Birmingham B9 5ST**

BLACKPOOL AND FYLDE HOSPITAL MANAGEMENT COMMITTEE

HOSPITAL ENGINEER

This modern Acute General Hospital of 540 beds is expanding rapidly to full District General Hospital status and includes regional services for cardio-thoracic surgery and cardiology. The maintenance of the mechanical and engineering services is the major responsibility for the successful applicant.

Applicants must have had a thorough practical training and must possess one of the appropriate qualifications approved by the Secretary of State for Social Services.

Salary £1917–£2220 per annum (inclusive of special responsibility allowance).

Application form and job description (which includes full information regarding the appropriate qualification) may be obtained from the Group Secretary, Group Offices, Victoria Hospital, Blackpool, FY3 8NR to whom they should be returned by the 2nd October, 1970.

Engineer Inspectors required at Northwick Park Hospital, Harrow, Middlesex. The hospital is in course of construction, and the appointment is anticipated to be for 12 months. Applicants must have served an apprenticeship in mechanical or electrical engineering and have had not less than 5 years' experience supervising site installations employing trades associated with mechanical/electrical engineering.

Salary scale: £1379–£1835

Application form from the Secretary, North-West Metropolitan Regional Hospital Board, 40 Eastbourne Terrace, London W2, quoting reference 220, returnable by the 25th September 1970

LONDONDERRY HOSPITAL MANAGEMENT COMMITTEE

HOSPITAL ENGINEER

Salary scale: £1514 × £44(1) × £50 (2) × £55(1) × £61(1)–£1774 per annum, with special-responsibilty allowance of £25 per annum.

Applications are invited from suitably qualified persons for the post of Hospital Engineer.

The person appointed will be based at Gransha Hospital, but will have duties at other hospitals in the Group, and will be responsible to the Group Superintendent, who is based at Altnagelvin Hospital.

The post is an interesting one in a large psychiatric hospital situated within a short distance of the city of Londonderry.

An attractive house is available in the hospital grounds. (In certain cases, removal expenses may be payable).

Application forms, together with details of qualifications required, may be obtained from Establishments Department, Altnagelvin Hospital, Londonderry, and should be returned on or before 16th October, 1970

FAIRFIELD HOSPITAL, STOTFOLD, HITCHIN, HERTS.

HOSPITAL ENGINEER

Applications are invited for the post of Hospital Engineer.

Applicants should be suitably qualified in accordance with the terms of PTB circular 191.

Salary scale: (24½ points plus): £1734–£2037 per annum plus £72 per annum special-responsibility allowance and up to 10% long hours gratuity.

Hospital house available at reasonable rental.

Application form available from and returnable to Group Secretary.

Closing date for applications 26th September 1970

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'Automation is one of the most immediate ways in which this country can harness its technological achievements to the improvement in productivity'

Anthony Wedgwood Benn,
former UK Minister of Technology.

The purpose of this new book '**Automation for productivity**' is to inform senior management of the benefits that can be derived from the application of computers and automation techniques in industry.

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Ten papers, presented at a conference held in May 1968 and sponsored by the IEE, MinTech, CBI, Industrial Automation Liaison Committee and UKAC, on systems already installed in a wide range of industries; the financial implications of automation; and the role of Government in the promotion of control systems.

122 pp., A4 size, photolitho, soft covers, 1968. price £2 14s.

Orders, with remittances, to:

Publications Department, IEE, Savoy Place, London WC2.

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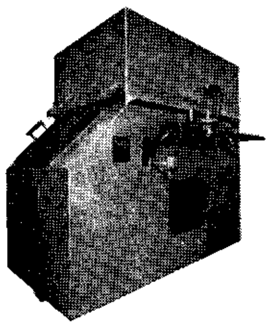

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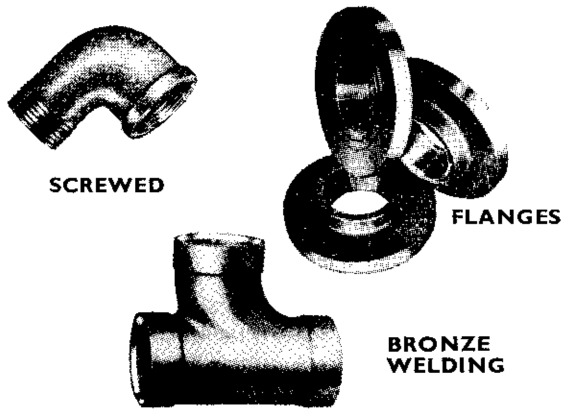

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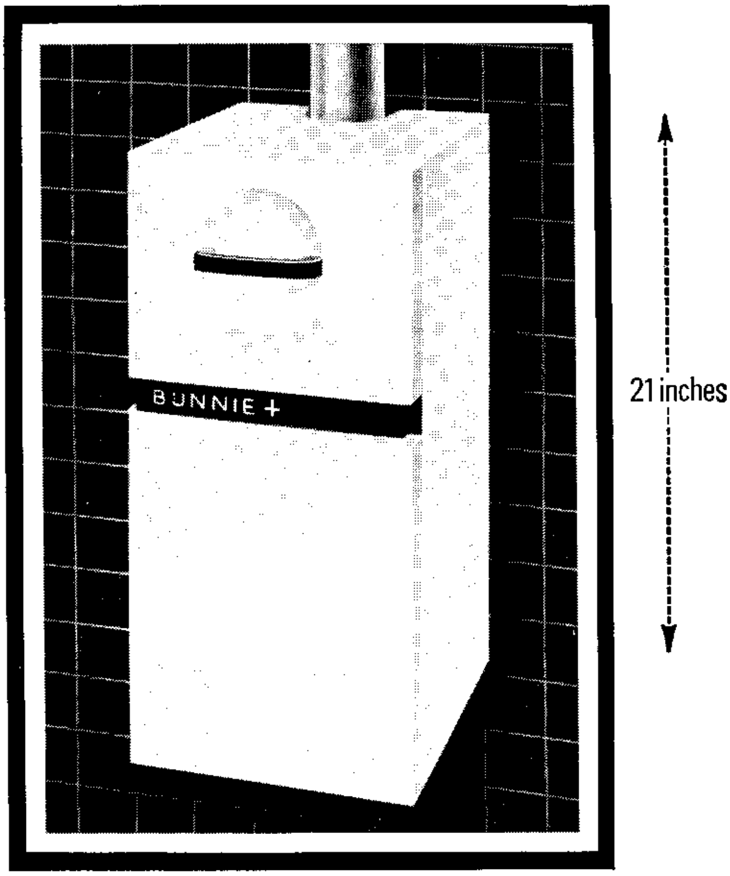
This is a mini-incinerator



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Wandsworth Electrical Manufacturing Co Ltd
Dept. HEA, Portman Chambers,
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