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## Editorial

THE subject of Central Sterile Supplies is one of gathering momentum and the medical press in particular has contained much interesting material in recent months. In his opening address at a symposium on " Sterilisation and Central Supply," organised by the Wessex Regional Hospital Board in Portsmouth for senior administrative medical officers, Dr. V. D. Allison, of Belfast City Hospital, referred at considerable length to the C.S.S.D. in Nuffield House, Musgrave Park Hospital, Belfast. This C.S.S.D. unit is a special project designed as a joint investigation into the value and economics of such a department by the Northern Ireland Hospitals Authority and the Nuffield Provincial Hospitals Trust. The department is a prototype capable of certain modification as work in it progresses and its planning was guided by a technical committee composed of representatives of various authorities able to draw upon the experience of bacteriological, medical nursing and administrative staffs. (It is interesting to note that no reference is made to engineering interests having been consulted in the planning stage.) Operational experience has shown that modifications to procedure and to certain equipment has been necessary as was expected and teething troubles have occurred with the sterilisers, one of which was a prototype.

The Musgrave Park unit has been set up to serve the one hospital and, as yet, insufficient knowledge has been gained to assess the economic aspect of the scheme. In this respect the results of the Wessex Regional Board's plan to set up two centres to serve the whole region will be awaited with considerable interest. Whatever else transpires, it is already evident from the experience gained in Belfast, and from the unit built up under the direction of Dr. E. M. Darmady in the Portsmouth Group for some years, that the trend is towards central units, either on a hospital or regional basis. There are various good reasons for expecting this trend to develop such as improved techniques in sterilisation, reduction in cross-infection, reduction of human errors, the saving of nurses' time and the abolition of ward boilers.

In summing up, Dr. Allison stressed that, because of the much greater load factor, failure of plant becomes extremely critical, and he suggests that regular inspection and servicing by the Engineering Department is essential as a preventive rather than a curative measure.

# Some Factors for Maintaining Efficiency on Boiler Plant

By J. M. McLEAN*
A.M.I.Mech.E., M.Inst.F.

*It is suggested that the maintenance requirements of $CO_2$ Recorders, together with the variety of instruments available, may be the reason why they frequently tend to be disregarded. The value of $CO_2$ content in flue gases as an indication of correct combustion conditions is stressed.*

*The paper is concerned with the achievement of optimum conditions in regard to combustion and heat recovery, and warns of the dangers of corrosion from unduly low flue gas temperatures.*

THE quantity of waste heat gases emitted from a chimney expressed as a percentage of the fuel burned is given by Siegert's formula.

$$\frac{k\,(T-A)}{CO_2}$$

where k = 0·35 coal steaming
0·31 oil
0·37 anthracite
0·39 coke
0·34 creosote pitch

T = Temperature °Fah.

A = Ambient temperature normally taken as 60° F.

This formula can be considered accurate for Industrial Practice, and in order to appreciate the quantity, let us take examples for COAL firing:—

$$\frac{0{\cdot}35\,(T-60)}{CO_2}$$

T and $CO_2$ being measured at the same point, i.e. the exit from the last unit, viz.:—

Boiler exit
Economiser exit
Air Heater exit

$T = 1{,}060°$ F.

$CO_2 = 10\%$

$$\text{Stack loss} = \frac{0{\cdot}35\,(1{,}060-60)}{10} = 35\%$$

Perhaps it is considered that an abnormal stack gas temperature has been assumed, although this can be obtained on Lancashire Boilers, especially where leakages occur between the brickwork of the down-take and the end of a Lancashire Boiler, so let us assume:—

$T = 560°$ F.

$CO_2 = 5\%$

$$\text{Stack loss} = \frac{0{\cdot}35\,(560-60)}{5} = 35\%$$

These examples have been shown to emphasise the importance of $CO_2$ as the stack loss varies almost directly with the temperature and inversely as the $CO_2$.

In general practice a stack temperature of 1,060° F. and 10% $CO_2$ would immediately command attention and subsequent action, but 560° F. and 5% $CO_2$ which can be found in practice would be acceptable as normal yet, as already shown, the loss is the same.

This concern for temperature and disregard for $CO_2$ would appear to be due to the availability of the measuring instruments at our disposal.

Temperature recording instruments, while delicate in construction, nevertheless are reliable provided

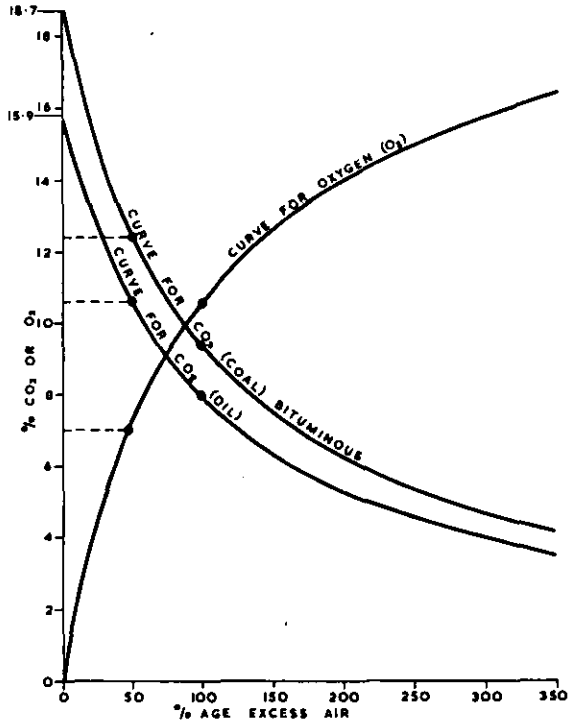


Fig. 1.

A paper read at the Joint Scottish Branches Weekend School.

*E. Green & Son Ltd.

they are treated with the care and attention which should be afforded to delicate instruments in the atmosphere of a boilerhouse.

On the other hand, $CO_2$ recorders are dealing with dust-laden corrosive gases, and filters for arresting the dust demand routine attention.

A simple instrument for local testing and checking of $CO_2$ recorders such as the Fyrite Tester will give practical readings of $CO_2$ with an operation as simple as inserting a pyrometer for temperature observation.

The art of combustion consists in causing chemical reactions which can generate heat, and takes place between the combustion matter, carbon and oxygen. The efficiency of this reaction is measured by percentage $CO_2$ or $O_2$.

To obtain practical combustion, air is used which consists of 21% oxygen and 79% nitrogen by volume. Nitrogen can be considered as an adulterant since it does not play any part in the combustion and has to be heated up to the temperature of the other gases, and thus lowers the temperature which is of major importance in heat transfer.

The principle of the oxy-acetylene burner for cutting purposes can be readily recognised, the high flame temperature being obtained by eliminating the nitrogen from combustion.

Due to using air for combustion, the maximum $CO_2$ for coal is about 18·7% (79% nitrogen) resulting from using the theoretical minimum amount of air. In practice this is unobtainable and excess air has, therefore, to be used.

**Excess Air**

In reviewing the many complex factors involved in obtaining maximum efficiency on steam raising and hot water boilers, the most important, by far, is *Excess Air.*

Instrumentation of a boiler house generally includes recorders, indicators or portable testers for observations of $CO_2$ or $O_2$.

It should be recognised that the readings observed from such instruments indicate the quantity of *Excess Air.*

In an endeavour to simplify the relationship between $CO_2$, $O_2$ and Excess Air, curves of $O_2$ and $CO_2$ for Coal and Oil are plotted against Excess Air. (Shown on Fig. 1.)

| | |
|---|---|
| 50% Excess Air: | 7·0% Oxygen ($O_2$) |
| | 10·6% $CO_2$ for Oil. |
| | 12·4% $CO_2$ for Coal. |
| 100% Excess Air: | 10·5% Oxygen ($O_2$) |
| | 8·0% $CO_2$ for Oil. |
| | 9·4% $CO_2$ for Coal. |

Observe that for maximum combustion efficiency $CO_2$ should be as high as possible and $O_2$ as low as possible.

Also that a definite $O_2$ reading corresponds to a definite quantity of Excess Air irrespective of whether the fuel is solid, liquid, gaseous, or a combination of fuels such as experienced in Steelworks where mixtures of Coke Oven Gas and Fuel Oil are being burned simultaneously in the same furnace.

In this case, $CO_2$ readings are difficult to comprehend since the exact quantities of the various types of fuels would have to be assessed, as the relationship between $CO_2$, and percentage Excess Air varies with the type of fuel.

Stack temperature for boiler plant, of course, is dependent on the design of the unit as, in the most efficient types of steam raising boiler, the exit gas temperature will be about 100° F. above saturation temperature and, if we consider this in the range for hospitals and assume the saturation temperature = 257+0·8 w.p. for (40–120 p.s.i.), we have 337° F. (338° F. steam tables) for 100 p.s.i.

The boiler exit gas temperature, therefore, would be in the regions of 450° F. Typical boiler exit gas temperatures are as follows:—

| | |
|---|---|
| Vertical | 700° F. upwards |
| Lancashire | 650° F. upwards |
| Economic | 400–650° F. |
| Water Tube | 550° F. upwards |

It has been endeavoured to improve on boiler efficiencies, either by increasing the heating surface in Water Tube Boilers or the rate of heat transfer by high-velocity gases in Economic Boilers, in order to eliminate the scope for heat exchangers at the boiler exit, and the minimum boiler exit gas temperature on Max. Continuous Rating corresponding to normal excess air requirements can be taken as 400° F. The more recent increase in boiler efficiency has been due to the advance in design of oil burners utilising less excess air without smoke, rather than the design of boiler.

Recovery of Waste Heat can be effected by installing at the boiler exit:—

(1) Air Heater
(2) Process Water Heater
(3) Economiser

The percentage Fuel Saving which can be effected (see Fig. 2, page 244) :

$$\frac{(T_1 - T_2) \times 100}{(260 \times CO_2) + 60 - T_2} \text{ for Coal}$$

$$\frac{(T_1 - T_2)\ 100}{(290 \times CO_2) + 60 - T_2} \text{ for Oil}$$

$T_1$ = Boiler Exit Gas Temperature °F.
$T_2$ = Heat Exchanger Gas Temperature °F.
= 300° F. upwards for Induced Draught
350° F. upwards for Natural Draught

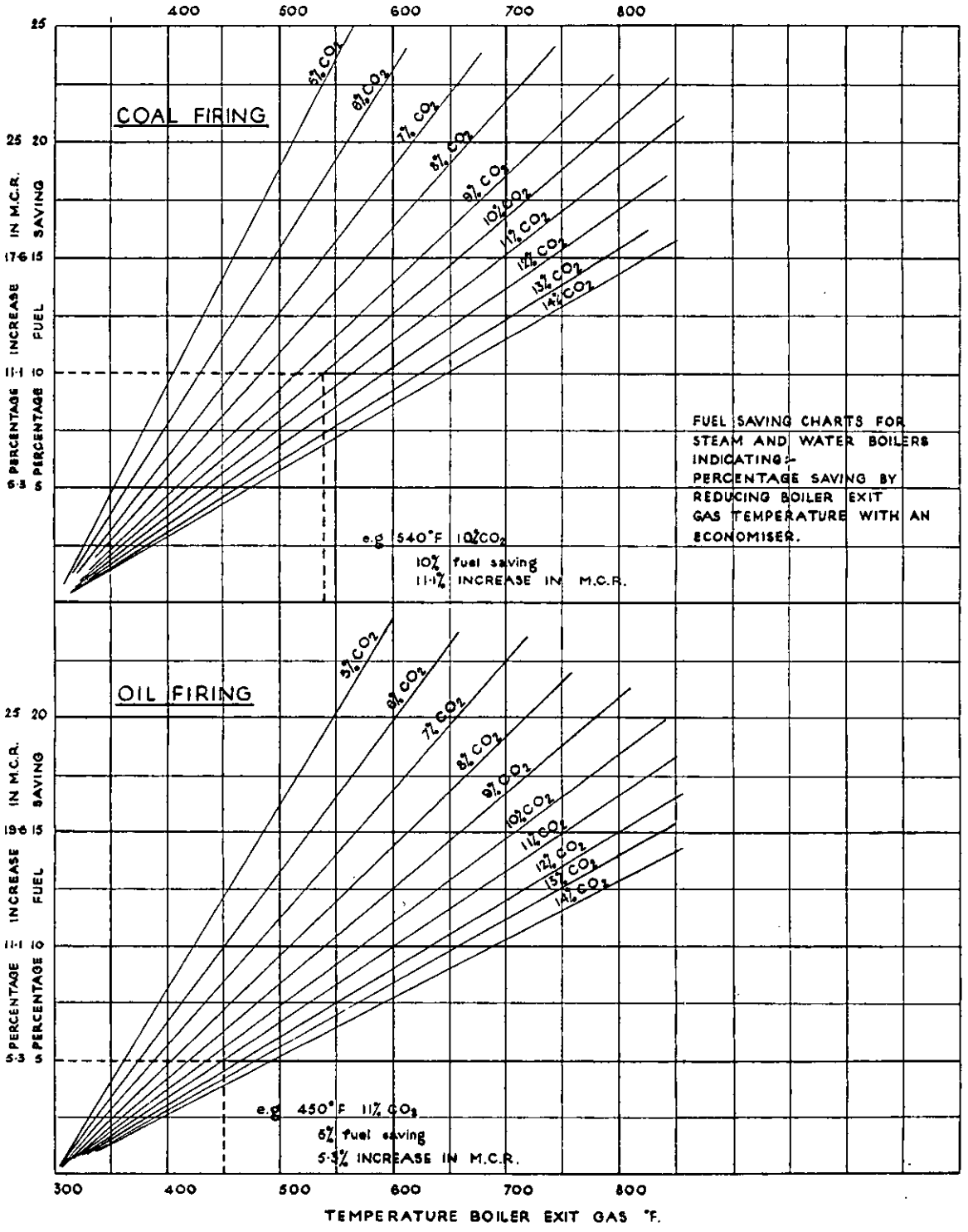
COAL FIRING
OIL FIRING
FUEL SAVING CHARTS FOR STEAM AND WATER BOILERS INDICATING:- PERCENTAGE SAVING BY REDUCING BOILER EXIT GAS TEMPERATURE WITH AN ECONOMISER.
e.g 540°F 10% CO2
10% fuel saving
11·1% INCREASE IN M.C.R.
e.g 450°F 11% CO2
6% fuel saving
5·3% INCREASE IN M.C.R.
PERCENTAGE FUEL SAVING
PERCENTAGE INCREASE IN M.C.R.
TEMPERATURE BOILER EXIT GAS °F.

Fig. 2.

Provided that the temperature of the air or water from the heat exchanger does not exceed specified limits, e.g.:—

**Air Heater**

Outlet temperature of air may be limited if air is required for combustion on chain grate stoker or as previously mentioned refractories. (Rise in Air Temp. ≒ fall in Gas Temp.) Recovery of heat is effected by raising furnace temperature and so heat transmission, but extent would be controlled by maintenance of stoker or furnace brickwork.

**Process Water Heater**

If open circuit outlet water would be less than 212° F. (180° F. in practice) otherwise loss would occur due to flashing.

**Economiser**

B.S. 1712 and 1713 for Cast Iron Economisers specified " design conditions shall be such that the maximum outlet water temperature shall not approach nearer than 40° F. to the saturation steam temperature in the boiler drum."

Then for working pressures between 40–120 p.s.i., the outlet water temperature=217+0·8 working pressure.

The given formula for Fuel Saving is most significant since the possible percentage fuel saving can be calculated from the temperature and $CO_2$ at the boiler exit, having selected the Heat Exchanger Gas Exit.

As it has been based on Seigert's values quoted in B.S. 845, it can be regarded as accurate for practical application in Industrial Practice. It has been derived so that:—

(1) The scope for Fuel Saving in all types of boiler can be readily assessed.

(2) It can be appreciated that the percentage fuel saving thus effected is due to increased efficiency by the recovery of heat from waste gases and is not affected by the Collection of Returns which may give a feed temperature of 180° F. (this being about the practical limit for feed pumps) and which is often regarded as dispensing with the scope for an Economiser, but such is not the case. Even with feed at 180° F. and a working pressure of 80 p.s.i. (satn. temp. 324° F.) there is scope for 10% fuel saving provided this can be obtained from the formula.

(3) In Hot Water Systems the fuel saving can be readily appreciated, although in practice it is very often disregarded, since the water rise across the Economiser may be only 5–10° F., and this appears to be considered on the same basis as the Economiser applied to steam raising boilers where the percentage fuel saving is estimated at 1% for every 10–11° F. *rise in water temperature.*

An efficiency test in accordance with B.S. 845, " Commercial Acceptance Tests for Steam Boiler and Hot Water Boilers," requires the following heat account calculated on the net calorific value of the fuel. The following item numbers correspond to those in B.S. 845:—

(41) Overall thermal efficiency.

(42) Loss due to sensible heat in chimney gases.

(43) Loss due to unburned CO.

(44) Loss due to combustible in ashes and clinkers.

(45) Balance radiation and other unmeasured losses.

(41) requires observations taken by steam or water meters which call for accurate testing as instanced in paragraph 26 of the code; assessment of dryness fraction and calorific value of fuel; the latter being only accepted for period of test in the case of coal where the size of fuel is of extreme importance.

It has been found from practice that (41) can be determined for practical purposes in a few minutes as follows:—

(41) Overall thermal efficiency
≒ 100—(42)—10%
or 90—(42)

i.e. the summation of (43) (44) (45) is accepted as 10%. This corresponds to an average value over a large range of tests. It is recognised, however, in the case of coal that this can be considerably larger depending upon the quantity and size of fines, but there is not much can be done to reduce this loss except perhaps change fuel, provided moisture content is taken care of.

$$(42)=\frac{k\,(T—A)}{CO_2}$$

k =0·35 for bituminous coal

k =0·31 for oil

T =Stack temperature °F.

A=Air supply to furnace °F., normally accepted at 60° F.

$CO_2$ as measured at same point as T

**Note**

Pressure and superheat do not affect design for maximum boiler plant efficiency.

From reliable recordings of the stack loss a variation in efficiency will be immediately recognised in a variation in the stack temperature or $CO_2$.

In many plants $CO_2$ readings are taken in the boiler exit while gas temperatures are taken at the stack.

With such arrangements there is very often infiltration between these points giving very wrong impressions.

For example, under these conditions the temperature fall due to infiltration can be approximated as follows:—

$$\text{Stack temperature} = \frac{CO_2 \text{ stack}}{CO_2 \text{ boiler}} \times \text{temperature boiler exit}$$

e.g. boiler exit 600° F. and 12% $CO_2$,

stack $CO_2 = 11\%$

$$\text{Stack temperature is} = \frac{11}{12} \times 600 = 550° \text{ F.}$$

equivalent to 50° F. fall per 1% fall $CO_2$.

It will therefore be recognised that stack temperature associated with a plant is meaningless without the corresponding $CO_2$ reading at a common test point.

Accepting this recommended practical method of assessing efficiencies the importance of accurate $CO_2$ readings are obvious.

To maintain combustion efficiency over a large fluctuating load presents problems. The M.C.R. of new and existing boiler installations are generally much larger than that required for the actual Maximum Demand. This in itself is not a serious defect but, if the combustion equipment installed is proportionate to the specified boiler M.C.R., then on the low loads it is difficult to maintain combustion efficiency.

It was observed that on two installations which were converted from coal to oil firing, one Lancashire Boiler was operating with the burner in one flue only under " Off-On " setting while on the other installation the burner was on for five minutes and off for 35 minutes.

In the case of chain grate stoker firing, $CO_2$ readings as low as 5% have been observed due to the grate being too large for the actual load or, in the case of unsuitable fuel, an increase in excess air is made to maintain the desired temperature of the grate. In fact, very often the recognised temperature of the grate is determined by finger touch without resorting to $CO_2$ readings.

In the case of oil firing, modern burner claims are made of 5 : 1 turn down ratios which implies that the burner can operate continuously at 20% of its maximum rating. However, a turn down ratio of 3 : 1 seems to be accepted in practice. Below its lower limit of continuous operation it operates on " On-Off."

It is difficult to maintain combustion efficiency on stoker firing at such turndown ratios.

It is therefore thought that the present standard of the M.C.R. of Shell type boilers should be accepted with a reduced grate area.

For example the M.C.R. could be obtained with a maximum firing rate of say 45 lbs. per sq. ft. instead of 35 lbs. per sq. ft. which is equivalent to reducing the length of the grate in the ratio of 35 : 45 so that the standard length of 6 ft. 6 ins. should be reduced to 5 ft. 0 ins.

Again, with the chain grate stoker, firing with an ash content of less than 8% should be discouraged unless a much higher grate temperature can be accepted.

In the case of a burner working on the " On-Off " setting it should be appreciated that cold air is being drawn through the whole boiler plant and is, of course, wasteful as well as being detrimental to the heating surfaces, as later shown by the effect of excess air with high sulphur fuels.

Oil firing has become more popular in this country following North American and Continental practice of boiler design—generally labelled " Packaged."

Units of this type in this country are either fire tube or water tube. Efficiencies of over 80% are claimed for such units. North American manufacturers claim 90% when a unit has been fitted with an air heater, economiser, and a superheater. As previously pointed out however, stack temperature and excess air determine the efficiency, and the maximum efficiency possible can only be obtained by installing an economiser or air heater.

To obtain such an efficiency the stack temperature would probably be in the region of 300° F. and, if such a temperature is desired, then it can only be obtained by installing an economiser on any type of water tube or fire tube oil-fired packaged unit, irrespective of the number of passes in the boiler, provided the feed temperature to the economiser does not exceed 200° F. These limits will provide a temperature difference of 100° F.

When a stack temperature of 300° F. is mentioned using high sulphur fuels, it conjures up Acid Dew Point, Corrosion, Fouling, Smut, etc. These undesirable features are functions of metal temperatures and excess air. Metal temperature is dependent upon the mediums on either side of the heat exchanger, i.e., gas: water or gas: air.

For example, with an economiser, the metal temperature can be controlled by the feed temperature and so tend to eliminate the undesirable features. This can be recognised in the protection of economiser tubes from corrosion due to the vapour dew point using low sulphur fuels.

It has long been the practice to pre-heat the feed water in an Economiser by means of the heat in the gases leaving the boiler. Since both coal and oil contain hydrogen, a certain amount of water vapour is formed during combustion. A very small amount of water vapour carried into the furnace by the combustion air goes to increase the total amount of vapour in the flue gases. Now, if the gases are cooled below the vapour dew-point by contact with relatively cool metal surfaces, such as Economiser tubes,

then a part of the vapour contained in the gases will be condensed and deposited on the outer surface of the tubes. For coal and oil firing, with the usual amount of excess air, the dew-points are, respectively, about 95° F. and 110° F. The actual wall temperature of the tubes will, of course, lie between the mean gas temperature and the feed temperature but, owing to the greater resistance to heat transmission on the gas side of the tubes, the wall temperature will be much nearer to the feed temperature than the gas temperature. Consequently, in order to prevent condensation or "sweating," the feed temperature at inlet to the Economiser should be somewhat higher than the dew-point of the flue gases. If condensation should occur, the sulphur dioxide or sulphur trioxide formed by combustion of the sulphur in the fuel will be dissolved in the water to form sulphurous or sulphuric acid respectively. As the condensate temperature is sometimes as low as 70° F. to 75° F., some pre-heating of the feed water is necessary.

This sweating can be readily recognised by observing a clean kettle filled with cold water on a gas stove, when moisture will form on the outside and remain until the water reaches a certain temperature.

In modern power station design feed temperatures in the region of 400° F. are quite common and the economiser exit gases must be greater than 400° F. Heat has to be recovered from these gases by means of an air heater designed to give a stack temperature corresponding to the permissible minimum air heater metal temperature of 165–215° F. according to whether fuel is P.F. or high sulphur oil.

The foregoing would appear to attribute the cause of the previous mentioned undesirable features to temperature but excess air is also a very influencing factor.

In a recent power station investigation of air heater corrosion and fouling on an oil fired unit, it was observed that when the $CO_2$ fell from 13% to 10%:—

Acid Dew Point increased from 300° F. to 345° F.

Rate of build up by about 700%.

Rate of wastage about $\frac{1}{32}$ in. per thousand hours.

In this area it has been established that on Vertical Economisers operating with high sulphur fuels, the rate of build up is such that when the $CO_2$ falls below 8% across the Economiser the scrapers are embedded in deposit. This build up can occur within a few months. The removal of this deposit necessitates spraying same with a solution of soda ash, and subsequent water washing.

In considering the problems associated with air heaters and high sulphur fuels, it should be recognised that M.S. chimneys are, in effect, air heaters subjected to much more severe conditions than those allowed for in air heater design. Air heaters are generally designed for a minimum inlet air temperature in the region of 100° F., whereas M.S. chimneys are subjected to the atmospheric temperatures. The problem here is not mainly corrosion but smut emission. Smut forms in the chimney from carbon deposits with acid inclusions. It is claimed that metal temperature is the cause of its formation due to the carbon building up in *fumerones* (long fingers of soot). The nuisance arises through the carbon being segregated in these fumerones and then released to atmosphere during operations such as sootblowing. To guard against this, external insulation in the form of aluminium sheets forming a $\frac{1}{4}$ in. annular space around the chimney practically eliminates the air heating effect on the chimney and maintains the actual metal temperature of the chimney at the gas temperature. It is interesting to note that the first experiment with this type of chimney in this area was installed where an economiser reduced the gases of packaged units to 300° F. without any apparent rapid corrosion of the economiser.

The importance of Excess Air and the advantages of an economiser on efficiency can be observed from the following formulae:—

Assuming Boiler Exit Gas ($T_1$) = 400° F.
Economiser Exit Gas ($T_2$) = 300° F.
k = 0·31 for oil
$CO_2$ = 10%

$$\text{Increase in efficiency} = \frac{k\,(T_1-T_2)}{CO_2} = \frac{0{\cdot}31\,(400-300)}{10} = 3{\cdot}1\%$$

$$\text{Percentage Fuel Saving} = \frac{(T_1-T_2)\,100}{290\,CO_2+60-T_2} = \frac{(400-300)\,100}{2{,}900+60-300} = 3{\cdot}75\%$$

$$\text{Percentage Increase in M.C.R.} = \frac{(T_1-T_2)\,100}{290\,CO_2+60-T_1} = \frac{(400-300)\,100}{2{,}900+60-400} = 3{\cdot}9\%$$

$$\text{Percentage Stack Loss} = \frac{0{\cdot}31\,(300-60)}{10} = 7{\cdot}5\%$$

Ratio:

$$\frac{\text{Gas Fall}}{\text{Water Rise}} \doteqdot \frac{CO_2-1}{4} \text{ for coal; } \frac{CO_2-1}{3{\cdot}5} \text{ for oil;}$$

which for the above conditions is $\frac{10-1}{3{\cdot}5} = 2{\cdot}57$

giving a water rise of $\frac{(T_1-T_2)}{2{\cdot}57} = \frac{100}{2{\cdot}57} = 39°$ F.

From the foregoing an engineer can assess the advantages of installing an economiser with any type of boiler since even with hot water boilers a large saving can be effected.

Regarding types of economisers, there is no gain in efficiency between the well known Vertical Tube and the Gilled Tube since both can be designed to give the same performance. Normally the Vertical is installed with plants operating on natural draught and troubles with draught problems very seldom arise. With the installation of an Induced Draught Fan however, on a brick setting, special care has to be taken to maintain at least 8% $CO_2$ at the Fan Suction. On investigation of complaints arising from overloading of I/D Fans on brick settings $CO_2$ readings as low as 2½% have been observed at the fan suction.

Here, again, the importance of Excess Air is pronounced, especially if a grit arrestor is installed.

There are many installations in hospitals of gilled tube economisers installed with Economic Boilers giving efficiency of 80% and over. In fact, there is one installation in this area where a gilled tube economiser is installed with two Economic Boilers and chain grate stokers, the economiser operating with either or both boilers and maintaining an efficiency of 84%.

In conclusion, it is hoped that sufficient has been mentioned to further discuss practical problems as encountered by engineers.

(The maintaining of availability on external surfaces is an extensive subject and a brief summary is given in *Notes on the cleaning of Economisers and Airheaters*, obtainable from E. Green & Son, Ltd., Wakefield.)

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## SOUTH WEST METROPOLITAN R.H.B.

The Report of the Central Laundries Department for the year ending March 31st, 1960, shows a period of marked progress. The turnover has been a record, standing at 28,878,250, which is an increase of 2,601,649 over the previous year, and the estimate by 735,250. This has been achieved at reduced cost by the replacement of old machinery and continued endeavour towards modern methods.

The Report adds:

" It will have been noted that as the years go by, so production per person per hour has increased, and it can be said that any capital expended in obtaining machinery and plant has had a two-fold result; it has enabled the additional work to be absorbed (the reason for which it was authorised) but, at the same time, it has enabled the increased turnover to be handled more expeditiously. It can be said, therefore, that capital authorised for the use of this Department has always shown a good return.

" There is, of course, a great deal of replacement still to be done (as apart from capital) and a start will soon have to be made on modernising the Farnham and Carshalton Laundries' washrooms, the machinery for which, in the main, is that supplied originally and is some thirty and twenty-two years old, respectively.

" The year has seen the completion of the Downs Laundry, the turnover (as calculated) running at some 60,000 articles per week. It may be interesting to recall that, at the ' take over ' some two years ago, the turnover was 5,000 articles per week at 11 pieces per operator per hour. This has now been increased to 30 pieces per operator.

" The whole of the layout of machinery, plant, alterations to buildings, etc., and the provision of drawings was carried out by this Department, as were the specifications and supervision of installation, etc., the saving in fees being not less than £4,000.

" The boilers are nearly sixty years old and supply steam to the hospital as well as the laundry, and are at the moment controlled by this Department. The Committee will be aware that it is intended to build a new boiler house, the boilers of which will act as a central unit for Sutton and Cheam and the Cotswold Wing, together with the Royal Marsden Hospital and the Laundry. It is hoped that this project will go through as soon as possible as the job of maintaining the present boilers is a difficult one.

".With the advent of the new boiler-house, plans can be made to extend the useful area of the Laundry. The old boiler-house, when cleared, could well form the washroom of the Laundry, thus making in turn more productive area available on the main floor."

The Central Laundries Department runs its own transport fleet of 35 vehicles and, in an effort to bring this more up to date, an order has been placed for three specially designed 3/4 ton vans.

In regard to water supplies and treatment the Report has this to say:

" Water Softening Plant has been brought up to date in two Laundries, viz: Carshalton & Farnham, which has been beneficial in both instances. There still remains Holloway Laundry where the water supplied by the H.M.C. is partially softened in a lime soda type of plant. The softener is grossly overloaded so that softening is inadequate and washing made difficult by varying degrees of hardness. The matter has been in hand for some two years and it is hoped to have an independent supply when full investigations have been completed by the Board's Officers.

" Water supply and storage has also been the subject of investigation at Chichester Laundry. Here the supply at one time was a dual one, i.e. Town's supply and the Laundry's own well. The Town's water costs approximately 2s. per 1,000 gallons and that from the well about 5d. Every effort has been made to make the well supply the whole of the demand—about 7,000 gallons per hour and still increasing. The storage tanks which are available are—one 8′ × 8′ × 9′ in the tower, and one 16′ × 6′ × 6′ above the roof of the sorting room. Both these tanks are thirty-four years old and it is intended to replace them with three of larger size so as to allow for greater storage, which will make the Laundry independent of Town supply.

" The cost of the replacement will approximate £1,500 and that of the additional tank £500. A sum of £2,200 has been allowed for in the Department's Engineering Maintenance for 1960/61."

The additional dry cleaning plant installed at Carshalton has fulfilled requirements but regret is expressed that the original plant has deteriorated to an extent whereby it is virtually useless and will have to be replaced.

# The Use of Plastics in Engineering

(PART II)

By L. H. COBB
B.Sc., A.R.C.S., D.I.C., Ph.D.

**Uses of Plastics in Engineering**

Some of the more important plastics materials and their engineering uses which exploit their desirable properties are now described. It will be obvious, however, from the foregoing background that a review of this kind cannot do much more than to skim the surface of the very wide field involved.

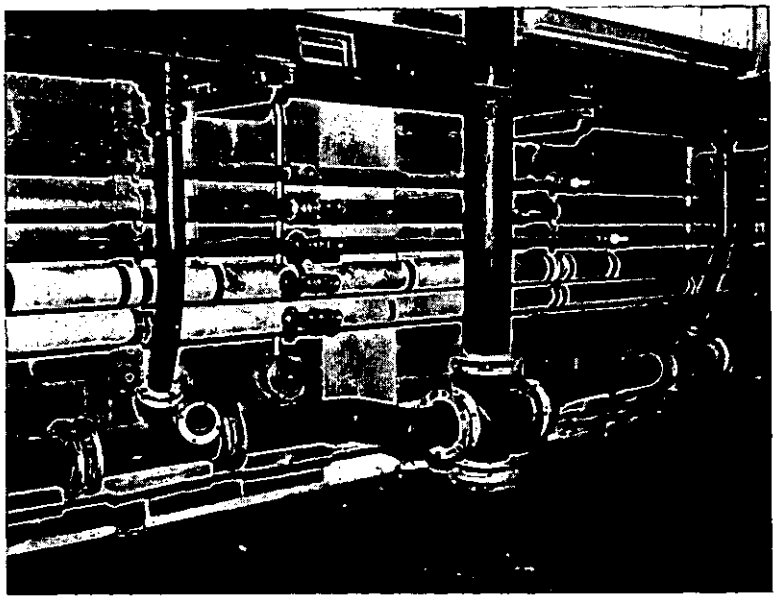
1. *Thermosetting Moulding Powders*

This type of plastics material need only be briefly mentioned since phenol formaldehyde (p.f.) mouldings, which broadly illustrate the group, will be known to all of you in the form of electrical plugs, switches, etc. in the home. The major engineering use of this class of plastics materials is, in fact, in the electrical field where components of good electrical insulating properties and rigidity are required. P.f. moulding powders suffer from their limitation to fairly dull colours and, where light colours are required, urea formaldehyde (u.f.) mouldings are often used, for example for housings of electrical mixing machines and hair driers. In applications where good arc resistance, dimensional stability and temperature resistance are important, the more expensive melamine formaldehyde and alkyd moulding powders are more suitable. These, for example, are often used for insulating components in power switch gear.

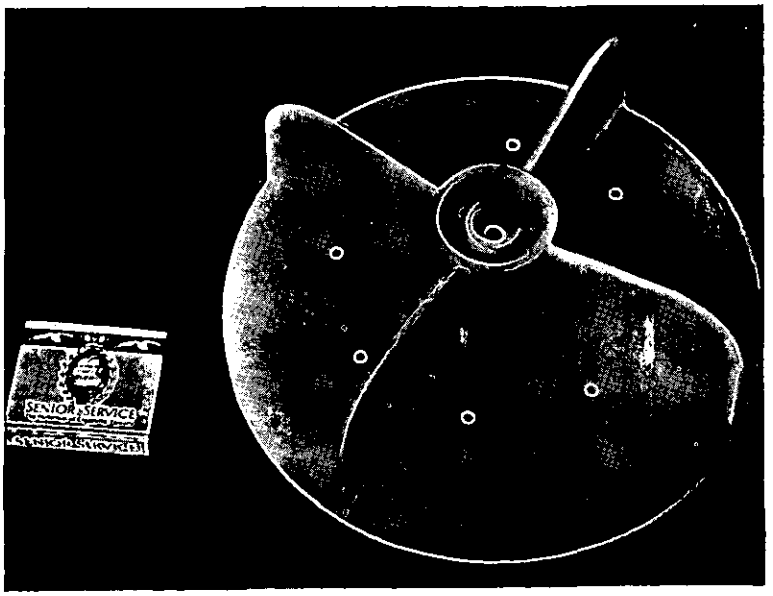
2. *Thermosetting Resins*

This class of plastics materials is of more general interest to engineers since a major use of thermosetting resins of the urea formaldehyde and phenol formaldehyde types is in the manufacture of rigid boards of various kinds, including plywood, densified wood, chip-board, straw-board, hardboard and also laminates made with paper, cloth and other fillers. Although some of the laminates are used by the electrical industry, for example p.f. paper laminate is the base commonly used for printed circuits, most of the above products find application in constructional work in buildings, whilst decorative laminates surfaced with melamine formaldehyde resins have become very popular also for table tops, bar tops, etc. both in the home and elsewhere. It is worth mentioning that laminated panels can be obtained in the form of thin skins separated by honeycomb structures or foamed plastics materials, giving a very high rigidity/weight ratio besides good thermal insulating properties.

A feature of polyester and epoxy thermosetting resins is their ability to cure at low pressures and when filled with fibreglass and other suitable materials, they can be converted into corrosion resistant mouldings of high strength/weight ratio, as has already been mentioned, using comparatively low cost tools. The fibreglass filled laminates are of particular interest to the mechanical engineer since they are the strongest type of plastics materials available. However, because the cycle of fabrication is relatively long compared with metal



**1½ in., 3 in. and 4 in. pipes made from "Alkathene" I.C.I. polythene installed at the Central Research Laboratories of The National Coal Board, Cheltenham, by Chemical Pipe & Vessel Co. Ltd.**




**Washing machine agitator moulded from "Propathene" I.C.I. polypropylene by Aeroplastics Ltd. for Acme Domestic Equipment Ltd.**

pressing, such laminates are particularly useful for the fabrication of large structures required in modest numbers, for which the capital cost of metal forming tools is relatively high, or where wood or metal is less suitable for technical reasons.

A very popular application of polyester/fibreglass laminates is the hulls of boats and cabin cruisers, and the serviceability of this type of material for the job can be judged by the fact that the U.S. navy has specified it for all its boats up to 50 ft. in length.[7] Other transport applications include structural components and radomes for aircraft, and bodies of caravans, buses and sports cars. Another major application for polyester/fibreglass is corrugated roof lights, whilst it also has numerous applications in the chemical plant field where its corrosion resistance is an advantage. Containers for solid objects ranging from suitcases to missile containers, where light weight combined with strength is important, is also another well established field of application. The size and weight of some of these reinforced plastics structures is quite interesting. A missile container 25 ft. long and 57 ins. internal diameter weighs less than 1,000-lb.[8] This size is exceeded by a fume scrubbing tower 47 ft. high and 10 ft. in diameter,[9] whilst probably the largest structure so far built from a large number of reinforced plastics components is a sphere 140 ft. in diameter, made up from 6 ft. hexagonal laminate panels with honeycomb cores, which was built to house an aerial of the Radio Corporation of America.[10]

Epoxy resin laminates can be used for similar purposes, but because they are more expensive they tend to be used in more specialised fields where their somewhat different properties, such as higher flexural strength and in certain cases better chemical resistance can be exploited.

3. *Thermoplastics*

The range of thermoplastics materials is much wider than that of thermosetting materials and for this reason it is necessary here to be more selective in dealing with this group. Nylon and polytetrafluoroethylene deserve to be mentioned first, because their use as plastics is mainly in fields of interest to engineers.

*Nylon.* There is a family of nylon plastic materials, but the type most commonly used in this country is called 66 nylon. It has a tensile strength of about 11,500 lb./sq. in. and the very low density specific gravity of 1·14, so that on a weight basis it is stronger than brass and aluminium. Besides being cheaper on a volume basis than brass, nylon can also compete well with aluminium die-castings and other metal components requiring expensive finishing operations. For this reason, nylon is being used to an increasing extent in suitable mechanical applications solely because the nylon component is found to be cheaper than the metal part it replaces. Good examples of this are the tops of soda water syphons, fans for motor car heaters and compressed air lines.

Many mechanical applications of nylon, however, exploit also some of its special properties, particularly its low coefficient of friction and resiliency when compared with metals. Thus nylon is a very suitable material for light duty bearings, cams, gears and other moving parts, particularly when these cannot be lubricated. In nylon, such parts also have an advantage over their metal counterparts in being very quiet in action and performing well

in dusty environments. Examples are linings in tractor suspension joints, bearings and strikers in motor car door locks and gears in ciné cameras, office machinery and windscreen wipers. Nylon is also used for seals and bearings in hydraulic and pneumatic mechanisms and railway buffers containing these nylon components illustrate their serviceability under arduous conditions.

Nylon also has outstanding solvent and alkali resistance, which is utilised in applications such as carburettor floats, lubrication hose and parts for alkaline batteries. It is one of the few plastics which can be steam sterilised, which is important, for example, in bottle washing machinery and in hospital use for applications such as anaesthetic mask mouthpieces, dishes, blood transfusion tubing and surgical sutures.

Electrically, nylon is not outstanding, but it has some electrical applications where mechanical properties are the main consideration, such as coil formers, insulating screws and as an abrasion resistant sheathing on cables.

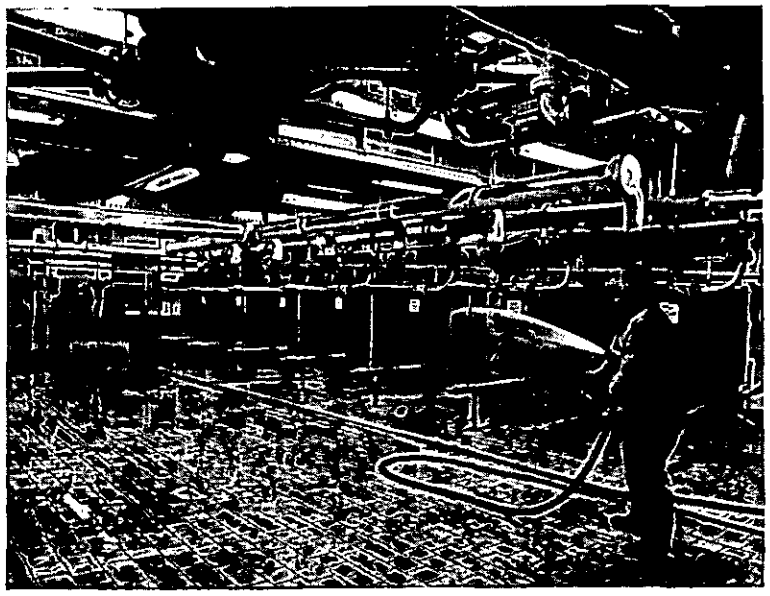
*Polytetrafluoroethylene.* It is worthwhile saying a little more about this plastics material, not only because its uses are mainly in the engineering fields, but also because it can be regarded as the " pearl " of plastics property-wise. In fact, p.t.f.e. has the best chemical resistance, all round electrical properties, widest temperature range and lowest coefficient of friction and lowest water absorption (nil) of all commercially available plastics materials. It also, incidentally, has remarkable anti-stick properties. However, as has been already mentioned, no material has all the virtues and although p.t.f.e. has many desirable properties, it has some disadvantages, of which the principal ones are that it is a very expensive polymer to produce, special fabrication methods which are comparatively slow must be employed and its mechanical properties are only moderate.

The high cost of fabricated p.t.f.e. tends to limit the use of this remarkable material to rather specialised fields, where other plastics materials either will not stand up to the conditions of use at all, or give a much inferior performance, or have only a short life requiring costly maintenance. Nevertheless, in the form of mouldings, extrusions and dispersions in water, p.t.f.e. is being used, even though in relatively small quantities, to solve design problems in all types of engineering applications.

Because of its virtually universal chemical resistance, p.t.f.e. is, of course, widely used in chemical plants for applications such as gaskets, packings, seals, pipes and hose, and parts of valves and pumps. In the electrical field, it is used particularly in electronic applications where high frequencies and wide temperature range are involved, for all sorts of insulating components and also for cable insulation. Purely mechanical uses are restricted to low friction ones such as in unlubricated bearings of various types, and where high and low temperatures are involved, for example in aircraft engine pipe clips. However, the anti-stick properties of p.t.f.e. give rise to many engineering plant applications such as coverings or coatings on moulds, rollers, hoppers, chutes and guides which come into contact with sticky substances.

Many applications of p.t.f.e., of course, utilise a combination of its properties, as in the case of p.t.f.e. hoses on aircraft, where flexibility, wide temperature range and resistance to fluids is required.

Finally, it is perhaps appropriate to mention that because of the very inert character of this plastics



**"Perspex" I.C.I. Opal acrylic sheet reflectors in anti-corrosion "Watershed" lighting fittings made by A.E.I. Lamp & Lighting Co. Ltd. installed at Guinness's Park Royal Brewery.**

**Acoustic tiles made by William Kenyon & Sons (Metamica) Ltd. covered with "Melinex" I.C.I. polyester film printed by R. A. Brand Ltd.**

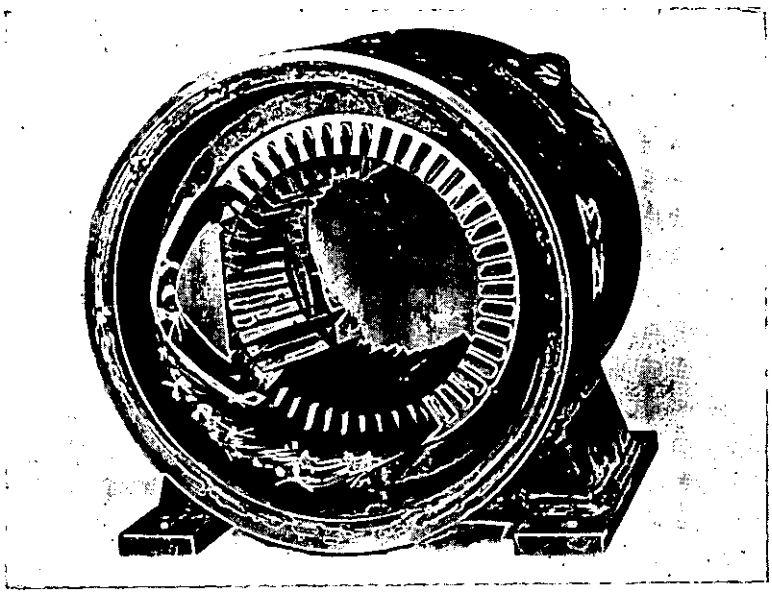
material, it is very suitable for certain surgical applications and, for example, arterial grafts woven from p.t.f.e. fibre are being used in heart surgery.

*P.v.c., Polythene and Polypropylene.* Polyvinyl chloride (p.v.c.) and polythene are our two largest tonnage plastic materials, U.K. production of each being around 100,000 tons/year. They are both relatively cheap and have an extremely wide range of uses. Although a large proportion of the output ends up in non-engineering applications, they must be specially mentioned if only because about 20% of the p.v.c. output and about 10% of the polythene output, which are still very large tonnages, are being used by the cable industry. Polythene, because of its low power factor, has been of vital importance to the electrical engineer concerned with the development of high frequency applications of all kinds, including radar and transcontinental telephone cables, whilst p.v.c. has replaced much conventional cable insulation and sheathing. In addition, these two plastic materials are the most commonly used in chemical plants, since, whilst they have not the universal chemical resistance of p.t.f.e., their resistance to acids and alkalis is excellent. They are relatively cheap and can be easily fabricated by moulding, extrusion and by welding together of sheet and other components. They can also be applied to metal as coatings, using various techniques.

Unplasticised p.v.c. sheet is more rigid than polythene and so is used to the greater extent for the fabrication of chemical plant where rigidity is desirable, such as in ducting, fans and large unsupported structures. This rigid sheet is also a very useful corrosion resistant cladding material in other fields and is used, for example, for lining of cold storage rooms and ceilings of railway carriages. Sheet of this type can be readily formed into three-dimensional shapes, such as chemical resistant fluorescent lighting reflectors and motor cycle windshields. Polythene has the advantage where some flexibility is desirable. Large quantities of polythene tubing have been installed for cold water plumbing and for agricultural water supplies and polythene is also particularly suitable for unbreakable chemical resistant containers ranging from squeeze bottles to 300-gallon carboys. These are very light in weight since the specific gravity of polythene is less than one. Even polythene film has some outlets in the engineering field. For instance, it is used as a water vapour barrier for packing of engineering components, in the curing of concrete and in the temporary glazing of buildings in construction.

One of the disadvantages of ordinary polythene (and also p.v.c.) is a relatively low softening point which usually limits their use to below 60°C. However, the advent of polythenes of higher density which can be boiled and the more recent development of the related material polypropylene, which at 110°C. is as stiff as ordinary polythene at 60°C. and which is form stable under unstressed conditions up to 145°C.–150°C. largely removes this limitation, although very long term performance at elevated temperatures of this order has still to be fully assessed. High density polythenes are, as has already been mentioned, stiffer than ordinary polythene, whilst polypropylene is even more rigid, particularly at elevated temperatures, but these rigidities are achieved with some loss of impact strength. For these and other reasons, these new materials are tending to find their own particular uses in the plastics field generally.

*Polymethylmethacrylate.* This plastics material is the most important of the so-called acrylics group and is noted for its very high transparency to light combined with good weathering properties and is, therefore, of particular interest to the lighting engineer. The corrugated sheet form of this plastics material is used for roof lighting whilst a very wide range of clear and translucent lighting fittings, and also opaque reflectors, both for inside and outside use, are made by the forming of sheet and the moulding and extrusion of powder. It is also the standard plastics material for moulding of motor car rear lights and has a variety of glazing applications ranging from aircraft canopies to television implosion guards. The clear plastic, in sheet, rod



**Partly wound motor stator made by Laurence, Scott & Electromotors Ltd. showing "Melinex" I.C.I. polyester film laminated to "Elephantide" used for slot and phase insulation.**

and tube form is a particularly useful material to engineers for making models, and its good optical properties are also exploited in surgical instruments in which light can be piped into body cavities. The use of polymethylmethacrylate, both in clear and coloured forms, for dentures and artificial eyes should also perhaps be mentioned.

The clarity of acrylic plastics permits the production of an extremely wide range of attractive opaque colours which are exploited in many applications of both sheet and mouldings ranging from sinks and baths to the new G.P.O. telephones.

*Polyester Film.* Lastly, it is worthwhile referring again to polyester film made from polyethylene terephthalate, partly because it illustrates a different sort of plastics product from those which have been specially mentioned and partly because it is the strongest plastics film commercially available. This fact, combined with its many other desirable properties, has led to many interesting applications in the engineering fields. Besides its great strength, polyester film also has excellent electrical properties and a very wide temperature range compared with most plastics films. It can, for example, be heated up to 180°C. for short periods and be used continuously at 120°C. It also has excellent solvent resistance, low water absorption and low gas permeability, and it can be easily vacuum metallised.

As might be expected, many of its applications fall in the electrical fields, where its use in place of other materials often results in important space savings. Thus the film is being employed for capacitor winding, in the insulation of transformers, in slot and phase insulation of electric motors, for magnetic recording tapes and for barrier tapes in cables.

In more general engineering fields, polyester film is being used for valve and pump diaphragms (e.g. in automobile petrol pumps), for light weight conveyor belting and for the packaging of engineering components. Roughened and photosensitised it provides a tough, dimensionally stable drawing office material of direct interest to design engineers. In acoustic installations, it is employed as a barrier film which may be printed to provide an external decorative covering for some types of acoustic tiles. This application should be of direct interest to hospitals, where high standards of cleanliness are necessary. Polyester film has also several chemical engineering applications, for example, linings for hoses conveying materials such as gases, hydrogen peroxide and liquid oxygen, and light weight cheap hoods for chemical plants.

## Conclusion

Although in this rather brief survey of uses of plastics in engineering, it has not been possible to cover the subject exhaustively, either product-wise or application-wise, the aspects mentioned will at least illustrate the wide variety of plastics materials and their engineering uses and perhaps also will suggest to Hospital Engineers, in their particular spheres of activity, some new uses for these materials.

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# Abstract of Reports

## ST. HELENS & DISTRICT H.M.C.

The full benefit from the several major capital schemes undertaken during the past year at **Whiston Hospital** will be felt in late 1960 and 1961. These are the new Burns and Plastic Surgery Unit and the central heating and domestic hot water services in the Nurses Home. The electrical services at the nurses' home have also been completely re-wired and will provide overbed lighting and points for radio sets. Work started in December, 1959, for converting Wards 9, 10, 11 and 12 into a Regional Centre for male and female plastic surgery cases. Included is Ward 14 which is being divided into two smaller wards allowing male and female E.N.T. cases.

In March, 1960, the scheme to convert the coal-fired boilers to oil-firing was completed. This plant will cope with the new demands of the Burns and Plastic Unit and E.N.T. Ward when they are completed, and with increased demands due to the recent central heating scheme, to the former E.M.S. Wards. A new calorifier shell was installed.

In the laundry, the old 8-roller ironer has been replaced with a modern 4-roller machine to which is coupled a spreader and automatic folder. Two large automatic tumbler driers, two large automatic hydro-extractors and a twin rapid press have been installed.

Exploratory work has been carried out on the land on the north side of St. Helens Hospital in preparation for the building of the Twin Theatre Suite and the two Surgical Wards, which is due to begin in 1961. An agreement was made between the Ministry of Health and the National Coal Board for the retention of the pillar of coal to support the Hospital and the proposed extensions.

Bathrooms and annexes were replanned in order to give sufficient space to provide a Clinical Room for each ward.

The Management Committee have continued to make representations to the Board about the need to make provision as soon as possible in their capital expenditure programme for the installation of the patients' lift at Cowley Hill Maternity Hospital. They have also been concerned about the need for certain improvements, some of which are to meet the requirements of the Central Midwives Board, such as in the nursery, and the need to separate the sluicing and sterilising facilities on the top floor of the main ward block. This last improvement cannot be carried out without considerable alterations to the building, and money for this work cannot be provided at present.

The installation of a tumbler drier has improved the equipment of the laundry. The main ward block has been painted internally and improvements to the lighting have been carried out.

At Widnes Accident Hospital arrangements have been approved for the improvement of the heating of the hospital, in the clinic rooms on the first floor, by the installation of additional radiators. Extensive internal painting has been carried out.

## ST. HELIER GROUP H.M.C.

Carshalton War Memorial Hospital is small and relies to a great extent on non-resident nursing staff, and it has been a problem to find accommodation for them in which to change. A small amount of alteration and redecoration in order to allot some additional space, for this purpose, in the nurses' home, has proved amply worthwhile.

A small amount of maintenance work has been done in the Sanatorium during the course of the year: Lavatory and washing accommodation was provided for the non-resident staff and the old Pathological Laboratory was converted into a changing room for domestic staff.

On July 10th, 1959, the building of the new Chest Clinic extension at Cumberland Hospital was officially opened, since when the Clinic and the X-Ray Department have been functioning with great success.

The character of the Hospital itself has been changing, and now not only tuberculosis cases are taken, but other chest cases, some of whom are extremely ill.

Nelson Hospital. In spite of the recommendation of the Management Committee to the Regional Hospital Board that this Hospital should be rebuilt, the final decision was that, though improvements would be carried out as finance made possible, any significant enlargement, or complete rebuilding of the hospital, could not be approved.

St. Helier Hospital had its greatest increase in beds in the year now under review, when the chest clinics which had been occupying Ward A.3 moved down to the new buildings which had been made for them at Cumberland Hospital. Here, the treatment given to patients is based on all the new methods, and the "hole in the heart" operation with the freezing of the patient beforehand is carried out.

A work study to be carried out on sterilising in a ward unit has been arranged. The work study which was carried out in the X-Ray Department by the Nuffield Trust led to a re-organisation and the installation of an inter-communication system. It has not been possible to get so far in the Theatre, where another work study was carried out, because first of all the Board are considering making some extensive alterations to the Theatre Unit and secondly, a considerable amount of expensive equipment would be necessary if the work study was to be fully implemented.

The building has suffered from the effects of bombing and from deterioration in the concrete foundations. Taking the outside of the building it is difficult to say exactly what damage has been done owing to the fact that the brickwork cannot be seen. It has, however, become quite obvious that there is a considerable amount, particularly to the parapets on which the Board are proposing to spend about £50,000.

An appreciable amount of maintenance work has been carried out, the X-Ray Department has been completely redecorated, many of the sluice rooms have been tiled.

One very important improvement has been the installation of the Multitone Call System.

Sutton and Cheam Hospital has been integrated with Downs Hospital. In consequence there is now only one hospital, Sutton and Cheam Hospital, which has become one of 282 beds.

Many other maintenance works were carried out in the main part of the Hospital. It is planned to move the autoclave from its present position as, at the moment, it prevents the enlarging of the nurses' dining room and the steam from it destroys the paint in the corridors.

At Wilson Hospital the King's Fund has drawn up a plan both to improve the layout and to replace much of the very old equipment of the Hospital kitchen. The new Pathological Laboratory was completed early in October, 1959. In addition to other minor works of alteration, the boiler house has also been improved and the old heating boiler replaced.

Wimbledon Hospital were also grateful to the King's Fund for re-organising their kitchen, the new working conditions being much appreciated by the kitchen staff.

A new autoclave was installed in the basement, as the old one broke down and was beyond repair.

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### FEDERATION OF RHODESIA AND NYASALAND TO HAVE OWN TEACHING HOSPITAL AND MEDICAL SCHOOL

*Announcing in Salisbury on September 23rd his* Government's decision to establish a multi-racial teaching hospital and medical school attached to the University College of Rhodesia and Nyasaland, the Federal Prime Minister, Sir Roy Welensky, said:

" Doctors are in short supply throughout the world and in addition existing medical schools are becoming overcrowded with fewer and fewer places available to students from abroad. In clear terms, the position to-day is that we can no longer continue to expect other countries to train our medical students nor expect other countries to supply the bulk of our demand for medical, nursing and allied professional people. The time has come to provide for our own needs.

" After most careful consideration, the Rhodesia Medical School Planning Committee have concluded that the advantages of having a medical faculty and teaching hospital in close proximity are so great that despite some increased capital cost for a hospital of this nature the building of a teaching hospital is justified. Therefore I am able to announce to-night that the Federal Government have accepted the obligation to build, equip and staff a teaching hospital of some 350 beds on a twenty-five acre site adjacent to the University College at Salisbury.

" It is estimated that buildings will cost about £1.4 million and that the annual operating cost including capital redemption will be in the nature of £½ million. My Government accepts this considerable responsibility in order to hasten and assure the progress of medical and health services of the Federation.

" The hospital is now being designed in collaboration with the University of Birmingham and with the Nuffield Foundation, who are extending co-operation in every way.

" The establishment of a medical school—a million pound project with an annual recurring charge of some £235,000 only slightly offset by revenue from fee-paying students—may seem a formidable task and indeed it is, but I am happy to be able to acknowledge considerable support already promised to the University Medical School, particularly from the Nuffield Foundation itself, which has made an offer of no less than a quarter of a million pounds.

" At the same time, the University of Birmingham has offered to sponsor medical degrees and I believe I speak for the whole Federation when I say how deeply appreciative we are of this action, which will enable our young medical students to receive degrees which will rank among the best, and to be taught by men and women of the highest quality and qualifications."

*Note:* The multi-racial University College of Rhodesia and Nyasaland accepted its first students in the Faculties of Art, Science, Agriculture and Education in 1957. It now has 226 students—58 of them Africans.

### EXTENSIONS TO EDINBURGH SOUTHERN HOSPITALS

At the present time, there are three proposed developments under consideration, these being as follows:—

**Deaconess Hospital**

Plans for providing spare storage capacity for the hot water system with interchanged tanks at an approximate cost of £8,000.

**Elsie Inglis Hospital**

A new isolation unit and staff accommodation at an approximate cost of £30,000.

**Liberton Hospital**

An extension of 90 beds (60 of which will be for long term chronic sick patients and 30 for Hemiplegics) at an approximate cost of £29,000. This scheme will probably include new heating services, new main kitchen and a new nurses' home.

# Forthcoming Exhibitions

### HEAVY BOOKINGS FOR 3rd INTERNATIONAL HOSPITAL EQUIPMENT EXHIBITION

135 exhibitors have already, by November 1960, reserved space for the 3rd International Hospital Equipment and Medical Services Exhibition. This third event will be held in the Grand Hall, Olympia, London, May 15th-20th, 1961, covering a total area of well over 100,000 square feet. Bookings to the extent of 60,000 square feet have already been received.

In 1959 it was decided to make this Exhibition a biennial event and, there is no doubt that, after a space of two years, the third presentation will break all precedent in quality and numbers of exhibits and attendance.

During the 6-day showing, conferences will be held on the premises by the following bodies : The Institute of Hospital Administrators (Annual General Meeting and 3-day Conference); the Institution of Hospital Engineers (Annual General Meeting and 3-day Conference); the National Association of Hospital Supplies Officers; the Society of Hospital Laundry Managers; the Chartered Society of Physiotherapists; the Guild of Public Pharmacists; and the Hospital Caterers' Association.

A Special Features Section will again form an integral part of the Exhibition.

Plans for this section are under way. They include a Ministry of Health Architectural Exhibit, designed by the Central Office of Information and the R.I.B.A.; a fully-automatic Canteen-Cafeteria, by the British Automatic Co. Ltd.; a display of some of the most modern medical equipment.

# B.S.I. News

*Abstracts of information supplied by the British Standards Institution*

## NEW BRITISH STANDARDS

B.S. 3258 : 1960 Silicone-rubber-insulated cables and flexible cords. 5/–

Gives requirements and dimensions for single-core, twin and three-core cables and cords insulated with silicone rubber, suitable for a maximum conductor operating temperature of 150°C. The quality of the insulation is specified by reference to B.S. 2899. Tests are included for conductor resistance, thickness of insulation, voltage withstand and insulation resistance, with a spark test as an alternative to the last two and a heat-cycle test for single-core, glass-braided flexible cords only. Dimensions are tabulated for 250V and 660V cables and flexible cables in conductor sizes up to 0·06 sq. in. and for 250V flexible cords in conductor sizes up to 0·007 sq. in.

B.S. 3260 : 1960 PVC (vinyl) asbestos floor tiles. 4/6

Lays down requirements, in regard to dimensions and physical characteristics for smooth surfaced homogeneous floor tiles, as well as giving methods of test in appendices.

B.S. 3261 : 1960 Flexible PVC flooring. 4/6

Covers materials supplied in continuous lengths or in tile form, with or without hessian backing. The material is homogeneous or laminated but all plies must be based on PVC.

The document lays down requirements in regard to dimensions and physical characteristics, as well as giving methods of test in appendices.

## REVISED BRITISH STANDARDS

B.S. 498 : —— Files and rasps
498 : Part 1 : 1960 Rasps and engineers' files. 8/6

Twenty-six types of rasps and engineers' files are illustrated, and their dimensions, tolerances and overall manufacturing requirements given.

B.S. 936 : 1960 Oil circuit-breakers for medium-voltage alternating-current systems. 15/–

Applies to three-pole oil circuit-breakers suitable for three-phase industrial and supply distribution systems having voltages up to 660V and breaking current not exceeding 43·3 kA.

The service conditions of which the circuit breakers are suitable are described and detailed requirements are given for the ratings, power-closing devices, releases and rating plates. Limits of temperature rise and certain clearances are given and type of routine tests are fully dealt with.

Supplementary information regarding the preferred form for enquiries and for manufacturers' information, selection and the calculation of short-circuit fault currents are given in appendices.

B.S. 1710 : 1960 Identification of pipelines. 6/–

Recommends an identification colour code for the contents of pipelines in buildings, industrial installations and also for water and land transport. The colour code is based on the use of ground colours which have been selected to distinguish the various different kinds of fluid or groups of fluid. Means by which pipelines can be more specifically identified either by colour bands and rings or lettering are also recommended. The identification of long-distance mains, either above or below ground level, is not included in this standard. Coloured illustrations of examples are given.

## BRITISH STANDARDS REVIEWED AND CONFIRMED

*The following British Standards have been reviewed in accordance with B.S.I. procedure and have been confirmed as satisfying present requirements:*

B.S. 749 : 1952 Underfeed stokers (ram or screw type)

B.S. 2619 : 1955 Method of test and rating for steam-heated air-heater batteries

## REVIEWED AND PROPOSED FOR CONFIRMATION

B.S. 2848 : 1957 Flexible insulating sleeving for electrical purposes (with published amendments)

## AMENDMENT SLIPS

*Please order amendment slips by quoting the reference number (P.D....) and not the B.S. number.*

| | Ref. No. |
|---|---|
| B.S. 449 : 1959 The use of structural steel in building. Amendment No. 1 | PD 3857 |
| B.S. 1016 : Methods for the analysis and testing of coal and coke Part 9 : 1960 Phosphorus in coal and coke. Amendment No. 1 | PD 3859 |
| B.S. 1762 : 1951 Woollen felt and woollen mixture felt for bedding, upholstery and similar purposes. Amendment No. 1 | PD 3873 |
| B.S. 1938 : 1960 Instrument tables (rectangular and curved) for use in hospital operating theatres. Amendment No. 1 | PD 3858 |
| B.S. 2051 : —— Part 2: 1954 Olive, soldered nipple and flared types of copper and copper alloy tube fittings for engineering purposes. Amendment No. 4 | PD 3884 |
| B.S. CP 339 : —— Domestic butane-gas-burning installations. Part 2 : 1956 Installations in caravans and small non-permanent buildings. Amendment No. 4 | PD 3863 |

## DRAFT STANDARDS CIRCULATED FOR COMMENT

AA(MEE)630 Stainless steel compression pipe fittings. (11 pp.).

AA(COT)1314 Regatta fabrics (as purchased by local authorities and hospitals). (9 pp.).

AA(B)1358 Cable covers (revision of B.S. 2484). (13 pp.).

AA(INE)1367 Indicating tachometers for general industrial use. (18 pp.).

AA(FSB)1409 Portable fire extinguishers of the dry powder type. (11 pp.).

AA(SAB)1696 Ceramic wash basins and pedestals (revision of B.S. 1188). (7 pp.).

AA(MEE)1710 Alloy steel chain slings. (37 pp.).

AA(ELE)2020 Measurement of electrical power and energy for acceptance testing. (26 pp.).

AA(ELE)2360 Electric cooking and heating appliances Part 1 : General specification. (30 pp.).

### HYDRANT INDICATOR PLATES (B.S. 3251 : 1960)

The increasing use of hydrant indicator plates and their present-day manufacture in a variety of materials dictated the need for this new 12-pp. publication. (Limited details only of these plates were originally included in B.S. 750—the standard for underground fire hydrants).

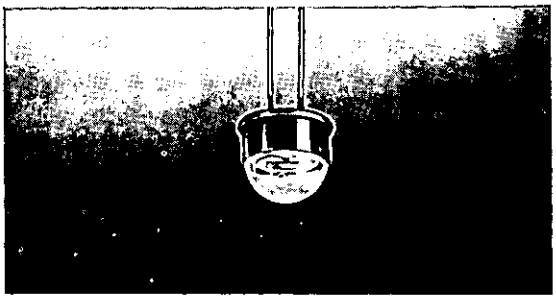
The standard deals with plates manufactured from sheet steel, cast iron, and aluminium alloy or plastics. Where they exist, British Standards are quoted for the materials.

The standard concludes with useful notes on fixing the plates. Dimensioned illustrations of the plates are given.

# On the Market

*A review of new equipment and materials and their development*

**Type V.021 cadmium sulphide photocell is an intracavitary type of radiation detector with applications in medicine and other fields where very small size is important.**



**Type V.022 is a standard cadmium sulphide photocell which could be used in large numbers for monitoring radiation over a wide area.**

## A.E.I. CADMIUM SULPHIDE PHOTOCELLS AS RADIATION MONITORS

The increasing use of gamma-rays in medicine and industry has created a need for radiation detectors of all kinds. Techniques developed at A.E.I. Research Laboratory, Harlow, Essex, enable the production of very pure single crystals of cadmium sulphide which, besides being light-sensitive, respond to higher energy radiation such as X- and gamma-rays.

Photoconductive cells employing single cadmium sulphide crystals have been developed and are now available in experimental quantities from Industrial Valve and C.R.T. Department, **A.E.I. Radio and Electronic Components Division**, 155, Charing Cross Road, London, W.C.2.

Two types of cell are produced. Type V.021 is an intracavitary cell suitable for medical use or other applications where very small size is essential. It is so small that it can be swallowed by or inserted into a patient and used to measure the gamma-ray absorption of tissue and organs—an important factor in the therapeutic use of radiation. Type V.022 is a standard cell suitable, if used in large numbers, for continuous monitoring of gamma-ray flux over a large area.

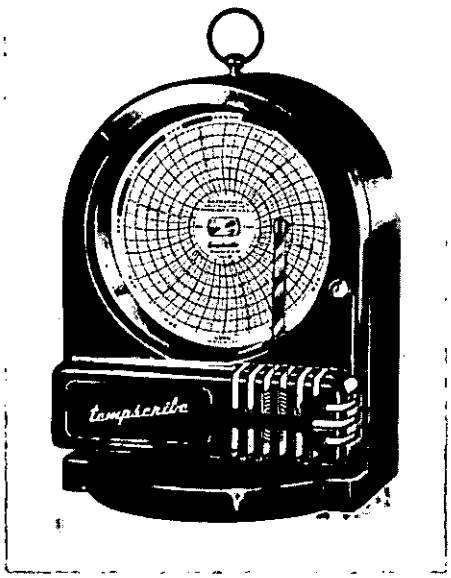
Both cells have a linear response to voltage and may be used under A.C. or D.C. conditions up to 100 volts peak. They may pass up to one microampere when supplied with 100 volts D.C. and irradiated with gamma-rays at 1 Roentgen per minute. Cells are individually calibrated against a Cobalt-60 source giving a flux at the crystal of 1 Roentgen per minute, and a typical curve showing the current passed by the cell under these conditions and the current decay and rise characteristics when the cell is withdrawn from, then reinserted, into the beam, is supplied with each.

## "TEMPSCRIBE" TEMPERATURE AND OPERATION RECORDERS

**Shandon Scientific Co. Ltd.** have recently introduced a new range of self-contained, portable temperature and operation recorders.

Models are available for recording ambient temperature, for remote temperature recording, for operation recording (e.g. the on/off cycling of electric heaters, fans, etc.) and for the simultaneous recording of both temperature and operation. These recorders measure only 5½ in. wide × 4½ in. deep × 7½ in. high.

For recording ambient temperature, the door contains a bimetallic element. For remote tempera-




**"Tempscribe" Ambient Temperature Recorder.**

ture recording, a bulb-type element is connected by 6 ft. of flexible capillary tubing (a special model with 10 ft. of tubing is available for biological refrigeration work, such as recording storage conditions of vaccine, serum, etc.); while for operation recording the door carries an electro-magnetic armature for parallel connection to the circuit concerned. The temperature/operation recorder contains both a bulb-type element and an electro-magnetic armature, each actuating a separate pen. Within certain limits (imposed by the rotation time of the clock mechanism), any recorder can be converted to perform a different function.

All " Tempscribe " models record on a circular chart 4½ in. in diameter. For ambient temperatures, charts are available covering 13 different ranges. For remote recording there are 6 charts.

For operation recording, 3 charts covering periods of 4 hours, 8 hours or 24 hours respectively are available; and for combined temperature/operation recording 2 charts. The special biological refrigeration chart is for 7 days and covers the temperature range —5°C. to +15°C.

Though designed primarily as portable instruments for occasional or periodic checks, they are equally suitable for permanent installation.

Prices for complete recorders range from £29 7s. 6d. for the ambient temperature recording model to £44 1s. 6d. for the biological model. These price differences arise from the varying cost of the doors. The case with clock mechanism, irrespective of the time period, costs £15 7s. 6d. Charts cost 34s. per 100.

## WARD IMPROVED WITH WARERITE

New ablutions and lavatories have recently been provided for one of the main wards at the Fountain Hospital, Tooting Grove, London. The hospital, one of the largest of its kind in the London area, deals solely with mentally-handicapped children.

Walls and ceilings of the two large rooms containing the improvements have been completely panelled with **Warerite** Regent wallboard—white on the ceiling and yellow for the walls. The material is bonded to battens with impact adhesive, and held in place by polished aluminium fixing sections. This material was chosen to reduce maintenance and obviate the need for frequent redecoration. The ward is scheduled for demolition within the next few years, but the wallboard will be salvaged and used again elsewhere in the hospital.

Floors of both rooms are tiled black, and equipped with underfloor heating, while lighting is provided by porthole-type lamps recessed into the ceiling.

## PHILIPS BI-PIN LIGHTING FITTINGS

Recently mailed to the retail side of the electrical trade, including dealers, contractors and electricity boards, is a new broadsheet dealing with Philips Bi-Pin fluorescent fittings, polyester-filled ballasts and rotor type lampholders.

It gives full details of the range, a complete list of type numbers and prices, and the whole of the centre spread is devoted to illustrations of various fittings available.

Copies may be obtained from Philips regional and branch offices.

Mr. H. B. Knight has been appointed a lamp and lighting representative attached to the Nottingham branch of the Midlands Region of Philips. He will cover part of the City of Nottingham.

**Part of the new ablutions and lavatories at Fountain Hospital. The walls and ceiling are panelled with Warerite wallboard in yellow and white Regent patterns.**

Members attending the Weekend School at Ailsa Hospital, Ayr. Back Row, l. to r.: W. Guthrie, Geo. Grieve (Stirling), Geo. Grieve (Riccartsbar), W. Nicholas, A. M. Ross, G. Millican, A. McAllister, J. Strachan, R. Burnett, W. Jack, J. Cuthbertson, A. C. Barr. Middle Row, l. to r.: H. Taylor, E. J. Moodie, C. McQuarrie, H. B. Pont, A. Anderson, W. N. Gray, W. Caldwell, A. McNiven, J. Cadenhead, S. Penman. Front Row, l. to r.: A. F. Gordon, Wm. Frew, J. Y. Nicoll, J. Brown, J. Panton, H. A. Adams (Chairman, I.H.E.), A. M. Hodgson, R. H. Smith (Ailsa), W. Runcio, J. B. Meldrum, D. M. Mackay, J. K. Clark, C. N. Anderson.

# The Scottish Weekend School

THIS School, organised by the three Scottish Branches, opened with a sincere welcome by Dr. H. J. B. Miller, Medical Superintendent at Ailsa Hospital, and Mr. Manson, Secretary of the B.o.M. for the Ayrshire Mental Hospitals. Mr. Manson paid fine tribute to the open-door policy of Dr. Miller which he had introduced.

Mr. R. H. Smith, as the morning session Chairman, then introduced Mr. J. K. Clark of the Western Regional Hospital Board Engineer's Department, who spoke on "Electrical Installations in a Hospital."

The speaker gave a brief résumé of installation procedure; the three main methods of internal distribution of a modern wiring system in a hospital block were metal trunking, screwed conduit and mineral insulated cables. On smaller installations, such as staff houses, tough rubber sheathed cable was sometimes used and, since it was initially cheap and had a long and satisfactory life, it was difficult to understand why an impression is often gained that this insulated system of T.R.S. is considered cheap and nasty. Trunking had its own advantages, mainly in new building work, but care had to be taken in neatness of erection and electrical continuity for earthing purposes.

The conduit system hardly needed any comment, it having been used for many years, but trouble had been experienced with unsatisfactory earth continuity which could have been prevented if the threads, backnuts, etc., had been red-leaded at time of installation. Mineral insulated cable was favoured for boilerhouse work under arduous conditions, but many contractors were offering the choice of this M.I.C. system or conduit and draw-in wires at the same price. There was no reason, said Mr. Clark, why a combination of these systems could not be used on the same contract. Many other points such as these were commented on with a summary of the different types of bedlights and lighting fittings.

The afternoon session took the form of a talk given by Mr. A. J. Lodge of Kelvin & Hughes Ltd., entitled "Boilerhouse Instrumentation." An explanation of controls, their accuracy and reliability was given, and their application to control of boilers, particularly those fired by stoker-fed solid fuels. The controls can deal equally effectively with A.C. or D.C. electric drives. A question was asked regarding capital cost which, in round figures, is £1,000 per boiler. It was concluded that this would be recovered in 1 to 2 years, or more, depending

on size and, hence, fuel consumption of plant.

On Saturday Mr. A. A. MacIver, C.A., F.H.A., Secretary and Treasurer, B.o.M. for Glasgow Royal Infirmary and Associated Hospitals, talked on "Organisation and Administration in Scottish Hospitals." The history of the present Health Service was briefly outlined, with an explanation of the various methods which could have been adopted for the control of hospitals leading to, in Mr. MacIver's words, the brilliant conception of the Regional Board which had an overall policy of co-ordination of Boards of Management, and so prevented overlapping of the services within one Region and achieving a co-ordination not possible due to the absence of liaison between Local Authorities in these matters. In this way, explained Mr. MacIver, the Boards of Management retained their authority in matters of day to day administration, although the Secretaries of these Boards were responsible to the Regional Board as employees. This may be thought to have led to a conflict of loyalties but the speaker said the arrangement worked well in practice. He went on to give details of procedure followed when new works and contracts were negotiated.

The afternoon's Chairman, Mr. J. Crawford, introduced the lecturer, Mr. J. M. McLean, A.M.I.Mech.E., M.Inst.F., who spoke on "Some Factors for Maintaining Efficiency on Boiler Plant." The speaker is a recognised authority on boiler economisers and associated problems. Question time produced quite a number of practical difficulties encountered with boiler plant in members' own hospitals.

The fifth and last session was on the Sunday morning and under the Chairmanship of Mr. H. Taylor. Members had the opportunity of putting written questions to a "Technical Forum" comprising four members elected from the meeting. Subjects considered were, whether laundries should have their own independent boiler plant; could the heating surface of a Lancashire boiler not be extended and so compete with the higher efficiency of the Economic type; what was the policy of the Department of Health concerning Lancashire v. Economic boilers; should National policy influence the choice of coal v. oil for fuel; why did architects still leave insufficient duct and other space for the accommodation and subsequent maintenance of engineering services; should steam boiler plant be left unattended whilst under pressure.

# Notes for Members

*News of I.H.E. activities, etc., and items of interest from Branches*

## MID-SCOTLAND BRANCH

A meeting of the Branch was held on August 27th in the Scottish Horse Club Rooms, Aberdeen.

In opening the meeting, Mr. W. Runcie, the Vice-Chairman, referred to the death of Mr. James Crichton. Mr. Runcie was joined by several members in paying a tribute to his memory, and the Hon. Secretary was asked to convey the sympathy of the Branch to Mrs. Crichton.

Mr. Panton referred to the arrangements being made for the Scottish Weekend School (a report of which is published in this issue). Mr. Panton also gave a report upon the Council meeting held in Harrogate on June 10th. He referred to the formation of a building sub-committee and engineering sub-committee on Committee "D".

A discussion took place concerning the leaving unattended of automatically controlled steam boilers.

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## WEST OF ENGLAND BRANCH

A meeting was held at the Weston General Hospital, Weston-super-Mare, on September 3rd.

The Hon. Secretary reported that he had written to the Regional Board on the question of a repeat of the lecture and demonstration on Autoclaving and Sterilising that had been given by Mr. Alder at the Bristol Royal Infirmary. He had learnt that Mr. Alder would be pleased to talk to engineers and said that invitations should, if possible, be extended to fitters and steriliser operators.

In regard to an artisan course for 1960/61, the Regional Board had agreed to co-operate with the Institution to organise a series of lectures, and Mr. W. L. Williams had agreed to act for the I.H.E.

The Regional Engineer had indicated that he felt that the position had not yet been reached, owing to limited experience as yet, to enable him to give advice regarding the types of pump that should be used within the Region for high vacuum sterilising purposes. Where there was no Superintendent Engineer, however, he would recommend that a maintenance contract be entered into with the makers.

The Chairman, Mr. R. L. Hanks, read extracts from H.M.(CD)58-2, Civil Defence Arrangements for Hospital Premises, and described the arrangements made within his own Group for civil defence

measures. Other members spoke of progress regarding this matter in their groups.

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## SOUTHERN BRANCH

A meeting of the Branch was held at St. James's Hospital, Milton, Portsmouth, on September 24th.

A discussion was held, the subject being Corrosion in Oil Fired Boiler Plant. Mr. E. C. Rogers opened the discussion and reviewed the causes of low temperature corrosion which is the most prevalent form in Shell type boilers. He also dealt with the question of sulphur, and endeavoured to put this in its true perspective. He went on to describe what could be done to reduce or prevent corrosion attack.

Mr. Rogers supported his remarks by references to papers published on this subject, and showed a number of interesting slides dealing with the points which he had made.

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## MIDLAND BRANCH

The Branch met at the Warnford General Hospital, Leamington Spa, on September 24th.

The Chairman opened the meeting by introducing Mr. Jeffries, Production Manager, and Mr. Baker, Design and Development Manager of Messrs. Allen & Hanburys Ltd., who gave a paper "Steriliser Development and Design." This paper proved intensely interesting and kept members engrossed for some two and a half hours.

It was reported that it was now only possible to take the City and Guilds Full Technological Certificate in Plant Engineering at the Borough Polytechnic, London, and the Branch felt that, as this was one of the qualifications accepted by the Ministry, Council should be asked to investigate the matter and see what could be done to improve the position.

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## SOUTH WALES BRANCH

A meeting was held on October 1st at the Temple of Peace and Health, Cathays Park, Cardiff.

Arising from the Council members' report at the previous meeting, clarification was requested regarding the future policy of Council in regard to professional aspects of the Institution's activities. The Council member agreed to investigate this.

Various items of correspondence were read including a letter to the Secretary reporting the situation with regard to the retirement age and qualifications of Superintendent and Senior Engineers within the Welsh Regions.

Various domestic matters were then discussed including various resolutions to Council.

The Hon. Secretary reported upon the Branch Weekend School which was held on September 24th and 25th and it was agreed to hold a similar school at the same venue in 1961. (A report of this event appeared on page 238 of our October issue).

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## YORKSHIRE BRANCH

The Yorkshire Branch held a meeting on October 8th at the Royal Infirmary, Bradford.

Mr. H. F. Pickering, Superintendent Engineer of Bradford "B" Group, gave a paper entitled "Assisted Engineering." This was well received and was of particular value to Senior and Assistant Engineers as was proved by the subsequent discussion. It was in fact continued after a break for tea, and, apart from formalities, occupied the entire meeting.

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## NORTH EAST BRANCH

The Branch held a meeting at the Liberal Club, Newcastle upon Tyne, on October 15th.

The Hon. Secretary reported the death of Mr. F. A. White and Mr. W. S. Newton since the previous meeting and members stood in silence.

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The Council Member gave a comprehensive report upon the meeting held in London on October 8th and said that Mr. R. G. Rogers would now be officially designated Deputy Secretary and Treasurer. Council had passed a resolution recording their appreciation of the sterling services rendered by Mr. Rogers, particularly in regard to his excellent work following upon the death of Mr. Forsyth.

The Hon. Secretary referred to the questionnaire which would be sent to engineers throughout Great Britain in connection with Whitley requirements and mentioned the three days extra annual leave granted to engineers with ten or more years service.

## EAST MIDLANDS BRANCH

The Branch held a meeting on October 15th at Kingsmill Hospital, Mansfield.

The Chairman opened the meeting by introducing Mr. R. A. Headland, M.A.S.E.E., of the National Inspection Council, who gave a paper "The Application of I.E.E. Wiring Regulations."

This paper was similar in many respects to that read during the residential course for Superintendent Engineers held earlier this year by the Sheffield R.H.B. Mr. Headland gave many interesting examples of correct and incorrect applications of the regulations, illustrating his points with practical specimens and slides. Slides showing improvements to switchgear layout were of particular interest.

The speaker stressed the danger of excessive bunching of cables in conduit owing to the heating effect and demonstrated the fire risk in these circumstances, particularly when using polythene cable. He gave an excellent demonstration of loop impedance testing, showing neutral and line loop tests.

Mr. Broxholme asked whether it was within the requirements to drill timber joists for the installation of p.v.c. cables. Mr. Headland replied that this did meet the requirements but stressed that the holes should be of adequate size and that care should be taken when feeding the cables in to avoid stripping. Cables should not be laid in slots in the tops of joists.

Mr. Gilmore asked if the speaker had any preference for V.R.I. or p.v.c. cable, to which he replied that there were applications for both types but that V.R.I. should be avoided in damp situations.

The remainder of the meeting was devoted to domestic matters and the Hon. Secretary reported that he had received an invitation for members to visit the Drayton Regulator and Instrument Co.

## LONDON BRANCH

The Branch held a meeting at the Westminster Hospital Medical School on October 15th.

The meeting, which was devoted to business matters, opened with a report by the Chairman on the Council Meeting held on October 8th. The number of new members elected had been noted particularly with reference to those from Nigeria and Rhodesia. The Worthing post of Superintendent Engineer had been discussed and the problem created there had been taken up by the Institution.

Details were given of the tentative arrangements for the 1961 Summer School and Conference which would take place during the Hospital Equipment Exhibition at Olympia from May 15th to 19th.

The Social Secretary reported on the Ladies' Night, saying that it had been a great success and those present had been particularly happy to have the Chairman and Treasurer of the I.H.E. present.

The meeting terminated with a discussion on the difficulties experienced by many members in filling posts in the assistant engineer grade.

## MIDLAND BRANCH

A meeting of the Branch was held at the Warnford General Hospital, Leamington Spa, on October 29th.

A further very full discussion was held regarding the deliberations of the Council Meeting of July.

Mr. F. J. Chance said that it was his sad duty to have to report the death of Mr. G. H. Siers, a retired member. Members stood in silence to his memory.

The Hon. Secretary reported that he had arranged a full programme of technical papers for 1961.

Various other business matters were dealt with and the meeting concluded at 6.15 p.m.

*(Continued from page 264)*

# REFRIGERATION
## for Mortuaries

This mortuary chamber was constructed by J. & E. Hall for the North Kent and Gravesend Hospital. It comprises two compartments, each cooled by a sealed 1/3 h.p. unit with 9" fan. Temperature within the chamber is maintained at 33/37°F.

J. & E. Hall also supply refrigerating equipment to hospitals for food preservation, blood plasma storage, and for laboratory purposes, including low temperature research.

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*A member of the Hall-Thermotank Group*

AP415

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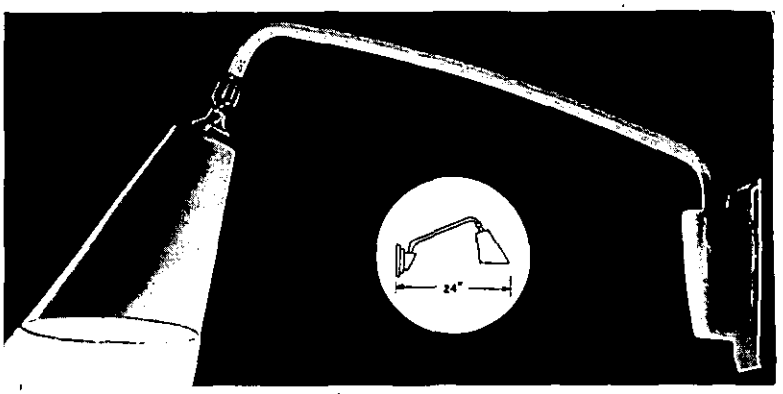
# Bedhead lighting by Hume Atkins

- A new design
- Swivel Arm-movement limited to prevent shade touching wall
- Reflector fixed or on non-rotating chrome plated universal joint
- Aluminium wall plate for fixing to conduit box — metal pattress available for surface conduit
- With or without Nylon cord switch
- Wired ready for use

CATALOGUE NUMBER HA732




*Catalogue—" Design for Lighting of Hospitals" and details of HA732 available upon request.*

HA

## Hume Atkins & Co Ltd.

Sales Offices and Showroom : 163 Victoria Street, S.W.1.

Telephone : VICtoria 2766/7

WORKS : ICKNIELD WAY, LETCHWORTH, HERTS.

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(*Continued from page A.26*)

SOUTH EAST METROPOLITAN REGIONAL HOSPITAL BOARD

Applications invited for the post of

ENGINEERING DRAUGHTSMAN

(Heating and Ventilating)

Salary within the range of £570-£1,300 according to experience and qualifications. Preference will be given to candidates who hold the Higher National Certificate or Sections A and B of the Institution of Heating and Ventilating Engineers (or equivalent) and have had suitable practical and theoretical training including site or workshop experience. Consideration will be given to experience as alternative to qualifications.

Applications stating age, qualifications, experience and present salary, with names of three referees, should reach the Secretary, 40, Eastbourne Terrace, W.2, by 9th January, 1961.

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BARNSLEY HOSPITAL MANAGEMENT COMMITTEE

SUPERINTENDENT ENGINEER

Applications are invited for the above appointment which will become vacant early in 1961. Salary as for a group of hospitals 20½—30 points, £930 increasing by annual increments to £1,090 per annum. Applicants must have passed an examination in engineering technology, and hold one of the following qualifications, or an approved equivalent qualification: Ministry of Transport & Civil Aviation (ex Board of Trade) First Class Certificate of Competency in Marine Engineering; Ministry of Transport & Civil Aviation Certificate of Service as First Class Engineer; City & Guilds full Technological Certificate in Plant Engineering (First Class).

The appointment will be subject to Whitley Council Conditions of Service, to Superannuation Regulations, and to satisfactory medical examination.

Living accommodation is not provided.

Applications giving full particulars, together with names and addresses of three referees, should be sent to Group Secretary, Barnsley H.M.C., Moorland Court, 33, Gawber Road, Barnsley, before the 31st December, 1960.

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BARNSLEY HOSPITAL MANAGEMENT COMMITTEE

SENIOR ENGINEER

Applications are invited for the post of Senior Engineer to be responsible to the Superintendent Engineer for the engineering services of the St. Helen Hospital, Barnsley, (up to 10 points) on the salary scale £670 increasing by annual increments to £805 per annum. Applicants must possess one of the following qualifications, or an approved equivalent qualification: Ministry of Transport & Civil Aviation (ex Board of Trade) Second Class Certificate of Competency in Marine Engineering; Ministry of Transport & Civil Aviation Certificate of Service as Second Class Engineer; Ordinary National Certificate in Mechanical Engineering which includes Heat Engines as a subject and is endorsed in the Principles of Electricity; Ordinary National Certificate in Electrical Engineering with endorsement in Applied Mechanics and Heat Engines.

The appointment will be subject to Whitley Council Conditions of Service, to Superannuation Regulations, and to satisfactory medical examination.

Living accommodation is not provided.

Applications, giving full particulars, together with names and addresses of three referees, should be sent to Group Secretary, Barnsley H.M.C., Moorland Court, 33, Gawber Road, Barnsley, before 31st December, 1960.

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GLANTAWE HOSPITAL MANAGEMENT COMMITTEE

ADELINA PATTI HOSPITAL,

Penycae, Swansea Valley

Applications are invited for the post of ASSISTANT ENGINEER at the above hospital.

Candidates must have served an apprenticeship in mechanical engineering and it is desirable that they should hold an Ordinary National Certificate in Mechanical Engineering which includes Heat and Heat Engines as a subject and preferably an endorsement in the Principles of Electricity or a Second Class Certificate of Competency in Marine Engineering.

The conditions of service and salary will be as laid down by the Whitley Council, i.e. £605 × £25 (4) × £30 (1)—£735 p.a. The Committee can grant one increment above the minimum in respect of relevant experience since the completion of practical training. The post is subject to the National Health Service Superannuation Regulations and to one month's notice on either side.

A house is available at a reasonable rental.

Application forms are available from the undersigned at Glantawe H.M.C., St. Helen's Road, Swansea, to whom they should be returned by Saturday, December 31st, 1960.

T. E. JONES,
Group Secretary.

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# MISCELLANEOUS

SUPERIOR QUALITY DIESEL GENERATING PLANTS

DORMAN DIESEL GENERATING PLANT

62½ KVA. 415/240/3/50

Dorman 6 cylinder radiator water cooled diesel engine direct coupled to a McFarlane alternator. 62½ kva. 415/240/3/50. ·8 P.F. 1,000 r.p.m. Comprehensive control panel. Fully metered. Automatic voltage regulation. The whole plant mounted on a substantial baseplate. 24v electric start. Manufactured 1954 and only used as a mains failure standby plant. Approximately 100 hrs. running only. In magnificent condition throughout and almost equal to new. £850.

McLAREN DIESEL GENERATING PLANT

62½ KVA. 440/3/50

McLaren 5 cylinder radiator water cooled diesel engine direct coupled to a Metro Vick alternator. 62½ kva. 440/3/50. ·8 P.F. 1,000 r.p.m. Mounted on baseplate. Control panel with automatic voltage regulation. 24v electric start. In excellent condition throughout. £750.

PETTER DIESEL GENERATING PLANT

125 KVA. 400/3/50

Petter twin cylinder water cooled diesel engine. 150 H.P. 500 r.p.m. Belt driving 125 kva alternator at 375 r.p.m. Compressed air start. Complete with petrol engine and compressor unit. This plant was installed and regularly maintained by the Manufacturers. Used only for mains failure purposes and in superb condition throughout. Full set of blue prints available for inspection. £1,250.

VIEW BY APPOINTMENT ONLY

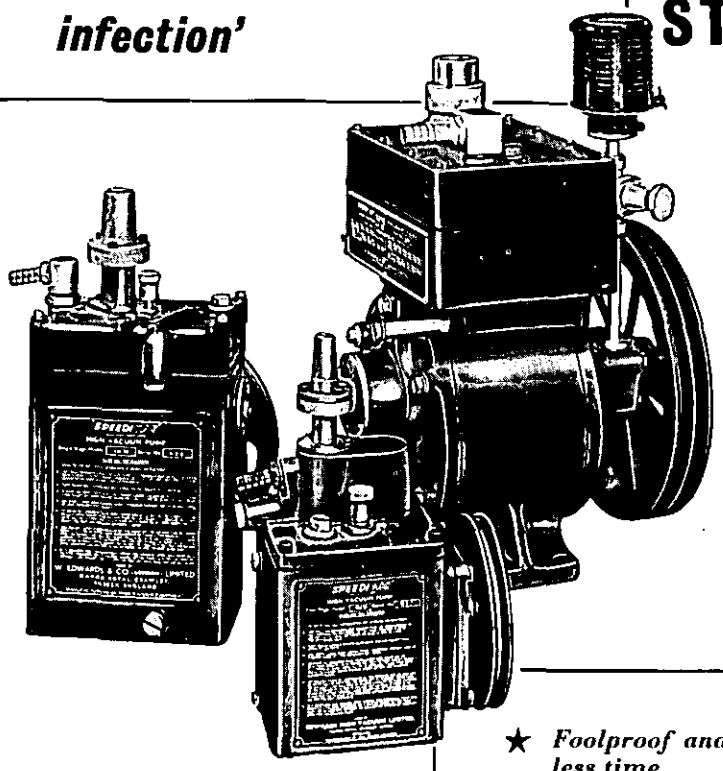
SPEED ELECTRICS, Church Street, Basford, Nottingham. Tel. 75716.

(*Continued on page 262*)

# "SPEEDIVAC"
## VACUUM PUMPS

***Reveal new ways of combating 'cross-infection'***

# HIGH VACUUM STERILIZATION



*Considerable research by various* medical research workers at eminent hospitals have proved that steam sterilization using high vacuum equipment is the most effective and the safest method of killing bacteria.

"SPEEDIVAC" high vacuum equipment comprising either single pumps or complete systems with valves, control and gauges is available for fitting to existing sterilizers or for incorporation into new installations.

| PUMPING UNIT | Capacity of Autoclave $Ft^3$ |
|---|---|
| VSP.150 | 2–8 |
| VSP.450 | 6–25 |
| VSP.900 | 12–50 |
| VSP.1500 | 20–80 |
| VSP.3000 | 40–160 |

- ★ *Foolproof and efficient sterilization in less time*
- ★ *Dressing life increased as less scorching occurs*
- ★ *"SPEEDIVAC" pumps readily achieve low pressures and high residual pumping speeds cope with any leaks*
- ★ *Air-ballast device and special lubricants protect pump from vapour contamination*
- ★ *Quiet running pumps, easily maintained by hospital engineers*

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